PB86-910209

U.S. DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 19, NUMBER 9
SEPTEMBER 1986

W86-03420 -- W86-03900
CODEN: SWRABW

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is produced by the Geological Survey, U.S. Department of the Interior, and published monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce.

SWRA is available to Federal agencies and their contractors or grantees in water resources research upon request, citing contract or grant number and sponsoring agency. Write: Water Resources Division, U.S. Geological Survey, MS 425, Reston, VA 22092. The **SWRA Journal** is also available on subscription from NTIS, 5285 Port Royal Road, Springfield, VA 22161. Annual subscription rates for the North American Continent are: Journal only, $115, Journal and Annual Indexes, $145; Indexes only, $50. Other addressees, write for prices.

Some documents abstracted in this journal can be purchased from NTIS. Price codes are given in the entries and a current code-price conversion table is printed on the outside back cover. Other documents are available from originating organizations or authors as indicated in the citation.

SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

VOLUME 19, NUMBER 9
SEPTEMBER 1986

W86-03420 -- W86-03900

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management and Budget through September 30, 1986.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Water Resources Scientific Information Center. The cumulative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey
MS 425 National Center
Reston, VA 22092

CONTENTS

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

DEVELOPMENT OF ETHANOL-SELECTIVE MEMBRANES,
Southern Research Inst., Birmingham, AL.
For primary bibliographic entry see Field 5D.
W86-03617

2. WATER CYCLE

2A. General

MILITARY HYDROLOGY; REPORT 3: A REVIEW OF ARMY DOCTRINE ON MILITARY HYDROLOGY,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 10F.
W86-03456

EVALUATION OF FUTURE BASE-FLOW WATER-QUALITY CONDITIONS IN THE HILLSBOROUGH RIVER, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W86-03546

APPLICATION GUIDE FOR HYDROLOGICAL SIMULATION PROGRAM: FORTRAN (HSPF),
Anderson-Nichols and Co., Inc., Palo Alto, CA.
A. S. Donigan, J. C. Imhoff, B. R. Bicknell, and J. L. Kittle.
EPA-600/3-84-065, June 1984. Environmental Research Laboratory, Athens, GA. 177 p, 19 fig, 17 tab, 3 app, 20 ref. 68-01-6207.

Descriptors: *Model studies, *Simulation analysis, *Fortran, *Computer programs, *Computer models, *Hydrologic models, *Water quality, *River basins, Models, Iowa River basin, Iowa, Infiltration, Rainfall-runoff relationships.

The Hydrological Simulation Program-FORTRAN (HSPF) is a set of computer codes that can simulate the hydrologic and associated water quality processes on pervious and impervious land surfaces, in the soil profile, and in streams and well-mixed impoundments. The entire application process of HSPF is documented for the Iowa River Basin Study to demonstrate the decisions, procedures, and results that are involved in a typical application. Process steps include study definition, development of a modeling strategy, operational aspects of HSPF use, input and management of time series data, model parameters and parameter evaluation, calibration and verification, and analysis of alternate conditions. These data are intended to supplement the existing HSPF user's manual and programmer's supplement to provide sufficient guidance for the full and intelligent use of the broad range of capabilities of the HSPF model.
W86-03614

STREAMFLOW SUMMARIES FROM TWELVE TRIBUTARIES OF FARMINGTON CREEK, DAVIS COUNTY EXPERIMENTAL WATERSHED, NORTHERN UTAH,
Forest Service, Ogden, UT. Intermountain Region.
J. M. Pankey, and N. V. DeByle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-117689, Price codes: A08 in paper copy, A01 in microfiche. 157 p, 14 fig, 223 tab, 64 ref.

Descriptors: *Watersheds, *Streamflow, *Water yield, *Precipitation, *Hydrologic data, Wasatch Mountains, Runoff, Catchment areas, Tributaries, Grazing, Land use, Canyons, Farmington Creek, Davis County Experimental Watershed, Utah, Rainfall-runoff relationships.

Streamflow in Farmington Creek, a 6400-acre, west-facing watershed in the Davis County Experimental Watershed, has been monitored since 1933. Of the 12 permanent tributaries, ranging from 50 to 464 acres, ten are in steep terrain, two are in more gentle terrain. Data had been collected to study the effects of stopping domestic livestock grazing, which had denuded the watershed and produced damaging mud-rock floods during intense summer rainstorms in 1923 and 1930. For the 12 catchments, mean annual flows are 10.19-25.95 area inches. Mean daily and monthly flows are also tabulated for all years of record, which range from 5 to 21 years during 1939 to 1972. A watershed description and topographic map accompany the data from each tributary. Monthly and annual precipitation records, measured at the Farmington-Rice Station from 1940 to 1972, are listed. Annual precipitation ranges from 29.44 inches to 51.47 inches. Although most of the annual precipitation falls as gentle rain or snow in autumn, winter, and spring, summer thunderstorms have produced very intense rainfall.
W86-03640

USER'S MANUAL FOR EXPLORE-I: A RIVER BASIN WATER QUALITY MODEL, HYDRAULIC MODULE ONLY,
Battelle Pacific Northwest Labs., Richland, WA.
Y. Onishi.
EPA 600/3-82-054, May 1982. Environmental Research Laboratory, Athens, GA. 126 p, 16 fig, 4 tab, 7 ref, append. 68-03-2613.

Descriptors: *Computer models, *Hydraulic models, *River basins, *Estuaries, *Water quality, *Reservoirs, *Mathematical models, *Computer programs, Models, Model studies, Mathematical equations, River systems, Hydrologic models.

EXPLORE-I is a computer program that simulates the dynamic hydraulic and water quality characteristics of a river basin. It can be used to study the effects of various flow conditions, waste discharge, and treatment schemes on the water quality conditions of lakes, reservoirs, rivers, and estuaries. EXPLORE-I consists of four computer program modules: hydraulic code for river and estuary flow, quality code for river and estuary systems, hydrothermal code for thermally stratified reservoirs, and quality code for thermally stratified reservoirs. The hydraulic and hydrothermal codes must be run first. This user's manual provides input instructions for the hydraulic module of the EXPLORE-I code. The hydraulic code solves two-dimensional problems with a modified set of one-dimensional Saint Venant equations by superimposing on the estuary or river basin a grid of junctions and channels simulating the actual physical system but allowing only one dimensional flow. Basic programming requirements of the code are given.
W86-03646

WATER QUALITY MONITORING: A SYSTEM'S PERSPECTIVE,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
For primary bibliographic entry see Field 7A.
W86-03655

DATA COLLECTION FOR HYDROCHEMICAL BALANCES: THEORETICAL ASPECTS,
Oslo Univ. (Norway). Inst. of Geophysics.
L. Gottschalk, and B. Webb.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 139-151, 4 fig, 36 ref.

Descriptors: *Hydrologic data collections, *Data interpretation, *Theoretical analysis, *Chemical properties, *Error analysis, *Statistical analysis, *Probabilistic process, *Hydrologic budget, Data collections, On-site data collections, Spatial distribution, Temporal distribution, Errors.

Methodologies are reviewed which may be used to evaluate data content, and uncertainties and errors in hydrochemical data collection and show how these problems can be reversed to one of collecting data in such a way that the data content is maximized or uncertainties and errors are minimized. It is difficult to use error statistics as an objective measure of the worth of hydrochemical data, since it is very difficult to relate errors to the cost of collecting the data. A small relative decrease in the error generally demands a substantial increase in collected data, and the relative benefit of these new data is hard to prove. However, the error terms can usefully indicate a minimum threshold level for the amount of collected data, below which it is impossible to draw meaningful conclusions. Estimated errors are a useful tool for comparing different strategies for data collection, and allow the evaluation of the importance of observations in space relative to observations in time. With respect to hydrochemical balances, this methodology allows the terms giving the largest errors to be analyzed, and indicates where corresponding improvements in data collection may be made. In order to successfully apply these methodologies, there is a need for basic information on variation patterns of hydrochemical elements in space and time and their corresponding scales.
W86-03766

HYDROCHEMICAL RELATIONSHIPS BETWEEN RAINWATER, FLOODS, GROUNDWATER AND LITHOLOGY IN THE AVEDAT GROUP ON THE NEGEV HIGHLANDS, ISRAEL,
Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.
E. Rosenthal, R. Nativ, and A. S. Issar.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 407-418, 2 fig, 7 tab, 11 ref.

Descriptors: *Rain, *Floodwater, *Groundwater, *Geohydrology, *Rocks, *Arid-zone hydrology, *Chemical properties, *Hydrologic models, Hydrologic data collections, Israel, Arid zone, Chemical reactions, Salinity, Salts.

The chemical composition of rainwater falling on the arid Negev is identical to that of rainwater collected over the sub-humid and humid central and northern parts of Israel. It is of bicarbonatic-calcic composition, with the only exception being the higher Ca-content encountered over the dusty desert area and a lower salinity level due to the greater distance of the investigated area from the Mediterranean seashore. The chemistry of floodwaters in the Negev is affected by the interaction of rainwater with the exposed rocks, the dissolution of soluble salts accumulated in the surface layers and ion-exchange with surrounding rocks. The floodwaters of the Upper Zin stand out due to their 25% higher SO4 content. In all floodwaters studied, the bicarbonatic assemblage of the causative rain was preserved. Along the flow-course of the Negev groundwaters, the dissolution of soluble salts from the surrounding rocks becomes the dominant hydrochemical process. The content of soluble Cl and SO4 in the Avedat rocks of the Negev is much higher than in the temperate regions of the country where the main factor influencing the chemistry of groundwater is the composition of rainwater. A model of the hydrochemical relations between rainwater, floodwater, groundwater and the input of soluble salts from the rocks of the Avedat Group was devised to summarize the experimental findings.
W86-03789

SURFACE AND GROUNDWATER MIXING AND IDENTIFICATION OF LOCAL RECHARGE-DISCHARGE ZONES FROM SEASONAL FLUCTUATIONS OF OXYGEN-18 IN GROUNDWATER IN FISSURED ROCK,
Uppsala Univ. (Sweden).
For primary bibliographic entry see Field 2F.
W86-03790

PROCEEDINGS OF STORMWATER AND WATER QUALITY MANAGEMENT MODELING USERS GROUP MEETING.
Environmental Research Lab., Athens, GA.

Field 2—WATER CYCLE

Group 2A—General

For primary bibliographic entry see Field 5B.
W86-03822

DYNAMIC MODEL ADJUSTMENT,
D. Hoang.
In: Proceedings of Stormwater and Water Quality Management Modeling Users Group Meeting, March 25-26, 1982, Washington, DC. EPA-600/9-82-015, August 1982. p 162-178, 1 fig, 1 tab.

Descriptors: *Mathematical models, *Computer models, *Mathematical studies, Runoff, Transport, Storm water, Calibrations, Vancouver Drainage Basin.

This project describes mathematical approaches to match simulated flows with the flows actually observed at a storm sewer monitoring station. A power series equation is developed and partial differential equations are substituted into the power series to yield a dynamic coefficient. The dynamic coefficient is time, flow and site dependent. The error in the dynamic coefficient is adjusted for depth and the sum of the squares of the residuals is minimalized. The Vancouver Drainage Basin is given as an example.
W86-03831

PREPARING A DESIGN STORM,
Gore and Storrie Ltd., Toronto (Ontario).
S. A. McKelvie.
In: Proceedings of Stormwater and Water Quality Management Modeling Users Group Meeting, March 25-26, 1982, Washington, DC. EPA-600/9-82-015, August 1982. p 191-209, 5 fig, 4 tab, 12 ref.

Descriptors: *Design storms, *Mathematical studies, *Storm water, *Synthetic hydrology, Mathematical models, Gumbel analysis, Rainfall, Watershed.

This project presents methods for, and comments on, constructing 'design' storms. The most commonly used synthetic design storms are the 'Chicago' design storms, the SCS Type II distribution, and direct use of the Intensity-Duration-Frequency (IDF) curve. The Gumbel analysis, or the Log-Pearson Type III analysis, is used on local weather station data to prepare the IDF curve. Regardless of which design is used, the duration of the design storm should be longer than the time of travel from headwater to outlet of the largest watershed.
W86-03833

PREDICTIVE MODEL FOR HIGHWAY RUNOFF POLLUTANT CONCENTRATIONS AND LOADINGS,
Washington Univ., Seattle. Dept. of Civil Engineering.
B. W. Mar, and R. R. Horner.
In: Proceedings of Stormwater and Water Quality Management Modeling Users Group Meeting, March 25-26, 1982, Washington, DC. EPA-600/9-82-015, August 1982. p 210-228, 10 fig, 1 tab, 8 ref.

Descriptors: *Mathematical models, *Urban runoff, *Pollution load, *Nonpoint pollution sources, Highway runoff, Lead, Zinc, Suspended solids, Copper, Phosphorus, Kjeldahl procedure, Nitrogen, Chemical oxygen demand.

This research presents a model with experimental verification for quantifying highway runoff pollutant concentrations and loadings. Composite samples from five hundred storms, at nine locations in Washington state, were analyzed for total suspended solids (TSS), lead, zinc, copper, total phosphorus, total Kjeldahl nitrogen and chemical oxygen demand. The model consists of a component for predicting total pollutant loadings over an extended time period, plus a series of charts with which individual event impacts may be assessed probabilistically. These elements have been assembled in a guidebook for evaluating aquatic impacts due to highway operations and maintenance. It is believed that the specific research findings and the proposed impact assessment procedures apply throughout the Pacific Northwest and that the techniques used to monitor storms and analyze the data are more generally applicable.
W86-03834

CHIMNEY HILL OFF-SITE DRAINAGE STUDY,
MMM Design Group, Norfolk, VA.
J. M. Normann, and E. R. Estes.
In: Proceedings of Stormwater and Water Quality Management Modeling Users Group Meeting, March 25-26, 1982, Washington, DC. EPA-600/9-82-015, August 1982. p 229-247, 7 fig, 5 tab, 7 ref.

Descriptors: *Mathematical models, *Urban drainage, *Drainage patterns, *Simulation analysis, Drainage canals, *Storm runoff, Runoff, Virginia Beach.

This project describes the successful application of the SWMM II model to the drainage system for the Chimney Hill subdivision of Virginia Beach, VA. The SWMM Version II model with EXTRAN option has been successfully applied to the simulation of a series of large storage canals, linked by culverts, and discharging into a tidal estuary. The results from the SWMM Version II model seem reasonable. However, due to shortcomings in the model, it would be beneficial to apply the Version III model to the data. A capability which would be very useful in the EXTRAN model would be the ability to simulate in-line weirs, as well as diversion weirs. In this study, weirs were simulated using short conduits, but instability in the model was a problem. Overall, SWMM Version II worked quite well in simulating the canal system, and the results confirmed the results of the hand calculations performed earlier.
W86-03835

2B. Precipitation

SCPP FORECASTING SUPPORT FOR THE PERIOD 1 DECEMBER 1978 THROUGH 30 SEPTEMBER 1984,
Electronic Techniques, Inc., Fort Collins, CO.
For primary bibliographic entry see Field 3B.
W86-03495

PROBABLE MAXIMUM PRECIPITATION ESTIMATES FOR THE DRAINAGE ABOVE DEWEY DAM, JOHNS CREEK, KENTUCKY,
National Weather Service, Silver Spring, MD. Office of Hydrology.
D. D. Fenn.
NOAA Technical Memorandum, NWS HYDRO 41, August 1985, 33 p, 12 fig, 17 tab, 12 ref.

Descriptors: *Probable maximum precipitation, *Orographic precipitation, *Mathematical studies, *Terrain analysis, *Drainage area, Probabilistic process, Probability distribution, Models, Model studies, Mathematical models, Precipitation, Prediction, Hydrologic models, Kentucky.

This report discusses estimates of probable maximum precipitation (PMP) for the drainage of Johns Creek, Kentucky above Dewey Dam. Estimates are given for duration from 1 to 72 hr for the drainage which is partly within a stippled region identified in Hydrometeorological Report (HMR) No 51, thereby necessitating evaluation of terrain effects on precipitation. Part of the procedures used to evaluate terrain effects required selection of proxy observations of precipitation since there were no reporting locations within the drainage. The remainder of the terrain evaluation procedure was the same as the one reported earlier in NOAA Technical Memorandum NWS HYDRO 39. As in the earlier report, the application procedures of HMR No 52 were used along with generalized PMP estimates from HMR No 51 to obtain a drainage average depth of nonorographic PMP. The final, or total, PMP estimates are the products of the drainage average depth of nonorographic PMP and the orographic intensification factor representing the evaluation of terrain effects within the drainage. (Author)
W86-03503

MULTI-PARAMETER REMOTE MEASUREMENT OF RAINFALL,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
D. Atlas, C. W. Ulbrich, and R. Meneghini.
Available from the National Technical Information Service, Springfield, VA 22161 as N82-33947, Price codes: A07 in paper copy, A01 in microfiche. NASechnical Memorandum 83971, July 1982 128 p, 19 fig, 1 tab, 108 ref.

Descriptors: *Rainfall, *Remote sensing, *Radiometry, *Radar, *Measuring instruments, *Microwaves, Parametric hydrology, Precipitation.

The measurement of rainfall by remote sensors is reviewed. One-parameter radar rainfall measurement is limited because both reflectivity and rain rate depend on at least two parameters of the drop size distribution (representative raindrop size and number concentration). A generalized rain parameter diagram, includes a third distribution parameter (breadth of drop size distribution), to better specify rain rate and remote variables. Simulations show the improvement in accuracy when combinations of two and three remote measurables are used. Remote measurables are reviewed. These include path-integrated techniques of radiometry and of microwave and optical attenuation. When paths are colinear, attenuation deduced from radar and radiometry agree well with direct measurements. Generally, dual wavelength radar methods designed to improve measurements in small range increments were disappointing. However, when estimated attenuation is used as a constraint on the retrieval of rain profiles from the radar, results are improved. Combinations of two or more of the three measurables, radar reflectivity, attenuation, and/or radiometry, produces promising results when sampling and air motion problems are considered. Dual polarization or differential reflectivity produces the best results in gate-by-gate measurements. Using a third parameter in addition to radar reflectivity factor and differential reflectivity is promising. Personal examination of the radar displays can greatly improve accuracy.
W86-03618

ICE FORMING EXPERIMENT,
Wyoming Univ., Laramie. Dept. of Atmospheric Science.
For primary bibliographic entry see Field 2C.
W86-03641

INVESTIGATIONS OF LARGE SCALE STORM SYSTEMS: FINAL REPORT,
Air Force Geophysics Lab., Hanscom AFB, MA.
A. A. Barnes, I. D. Cohen, and D. W. McLeod.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-119862, Price codes: A03 in paper copy, A01 in microfiche. AFGL-TR-82-0169, Environmental Research Paper No. 779, June 8, 1982. 44 p, 5 tab, 4 ill, 21 ref, 2 append. 2310.

Descriptors: *Atmospheric water, *Meteorological data collection, *Weather data collections, *Precipitation, *Cloud physics, *Storm morphology, *Crystal growth, *Cyclones, Data collections, Aircraft, On-site data collections, Spatial distribution, Weather, Storms, Clouds, Particle size, Snow.

The microphysics of Large Scale Cloud Systems (LSCS) were investigated using in-situ measurements taken from two specially instrumented U.S. Airforce Aircraft, the MC-130E and a Learjet 36. Data was collected on the distribution of liquid and ice water content, particle size distributions, crystal habits and other meteorological parameters. The LSCS flights helped verify and extend the model of Lo and Passarelli (1981) for studying snowflake growth and also contributed to data being collected in the CYCLES (Cyclonic Extratropical Storms) program by the University of Washington. The morphologies of three storms as they crossed the U.S. were studied in detail. Cirrus cloud studies detected the existence of subvisible cirrus, background cirrus (particles in the 1-10 micron size range) and large isolated ice crystals (a form of subvisible cirrus). The airforce can use this information to gauge hydrometer hazards to reentry and weaponry vehicles and predict possible

effects on laser systems. The results of this task may also advance the formation of weather prediction models.
W86-03647

HYDROCHEMICAL BUDGETS OF SOME DUTCH WOODLAND SOILS WITH HIGH INPUTS OF ATMOSPHERIC ACID DEPOSITION: MOBILIZATION OF ALUMINUM,
Agricultural Univ., Wageningen (Netherlands).
For primary bibliographic entry see Field 5B.
W86-03774

APPLIED CLIMATOLOGY.
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Geographisches Inst.
Proceedings of the 25th International Geographical Congress Symposium No 18: Applied Geography, August 21, 1984, Zurich, Switzerland. No 14, 1984. Edited by W. Kirchhofer, A. Ohmura, and H. Wanner. 108 p.

Descriptors: *Climatology, *Alpine regions, *Runoff forecasting, *Model studies, Hydrologic budget, Glaciers, Snowmelt, Planning, Hydroelectric power, Precipitation, Evaporation.

Current research in the field of applied climatology, presented during the 25th International Geographical Congress Symposium, is described. Topics of discussion include urban climatology, applied topoclimatology, and the use of model studies and of satellite data in the field of applied climatology. Studies have been carried out in alpine regions on various topics relating to water resources: knowledge of water resources in relation to climate; use of discharge forecasting from glacierized areas to optimize hydroelectrical power management; and the regional water balance in the mountainous Artic and its application for water resources planning. (Halterman-PTT)
W86-03846

VIEW ON OUR KNOWLEDGE OF WATER RESOURCES IN RELATION TO CLIMATE IN THE ALPS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
H. Lang.
IN: Applied Climatology, Proceedings of the 25th International Geographic Congress Symposium No 18: Applied Geography, 1984. p 53-58, 5 fig, 23 ref.

Descriptors: *Climatic data, *Alpine regions, *Precipitation, Glaciers, Snow cover, Evaporation.

Studies on the interrelationship between climate and water resources in mountain areas (specifically, the Alps) are reviewed, with emphasis on suggestions for future research. The hydroclimatic components considered are precipitation, evaporation, snowcover, and the glaciers. A major problem is the lack of reliable and complete records of the high altitude regions. Data are presented on longterm variations in annual precipitation and summer temperature, using information collected in Geneva from 1835-1978. Evaporation is the least studied of the processes, but is an important one because evaporation figures provide an essential link between climate and water resources, and in the determination of groundwater recharge and soil moisture deficit. Snowcover and glaciers are important research topics because they reflect both precipitation and heat balance conditions. Suggestions are made for future studies on both long-term and short-term aspects of the climate-glacier relationship. (Halterman-PTT)
W86-03847

2C. Snow, Ice, and Frost

FLOODS OF MARCH 1982, INDIANA, MICHIGAN, AND OHIO,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03552

ICE FORMING EXPERIMENT,
Wyoming Univ., Laramie. Dept. of Atmospheric Science.
Available from the National Technical Information Service, Springfield, VA 22161 as N82-33948, Price codes: A04 in paper copy, A01 in microfiche. NASA-CR-170623, July 30, 1982. 205-6 Final Report. National Aeronautics and Space Administration, Huntsville, AL. 70 p, 8 fig, 17 ref, append. NAS-8-33150.

Descriptors: *Ice formation, *Cloud physics, *Cooling, Supercooling, Nucleation, Precipitation.

The sharpness of the boundary which develops as a supercooled water cloud evaporates in the vicinity of ice was studied in several laboratory experiments conducted on a cold stage. A droplet-free zone began to develop around the ice patches immediately after deposition of the droplet layer. The zone grew in size and its boundary remained easily discernible to the eye. The size of the droplet-free zone showed a nearly linear increase with time for ice patches having straight edges; a gradual decrease in the rate of growth in the width of the droplet-free zone for a circular ice patch. The initial rate of growth of the zone, for periods less than 10 sec, appeared to be faster that of subsequent growth.
W86-03641

WORLD GLACIER INVENTORY WORKSHOP: PROCEEDINGS OF THE WORKSHOP AT RIEDERALP, SWITZERLAND,
World Glacier Inventory, Riederalp (Switzerland). September 17-22, 1978. IAHS-AISH Publication No 126. 1980. 351 p. Edited by F. Muller and K. Scherler. 117 fig, 70 tab, 480 ref.

Descriptors: *Glaciers, Symposium, *Glaciohydrology, *Glacial drift, *Glacial streams, *Glacier surges, Hydrologic data collections, *Glacier balance, Satellite technology, Conferences, *Glaciology, Baseline studies, Data collections, Data processing, Data acquisition, Data interpretation, Climatology, Firn, Glacier mass balance.

This workshop which took place in Valais, Switzerland from September 17 to 22, 1978 was organized by the Temporary Technical Secretariat for the World Glacier Inventory of the International Commission on Snow and Ice. The main topics of the workshop were: techniques of glacier inventory data compilation, including use of satellite imagery; specific inventory difficulties with Greenland and Antarctica, rock glaciers, surging glaciers, with the firn and equilibrium line and with glacier identification and classification; the problem of glacier fluctuations causing an uneven data base; data handling and organization in an inventory data bank and retrieval system; analysis of national, regional and global glacier inventories for practical purposes and in particular for monitoring climatic change. The proceedings contain all but one paper presented at the workshop and most of the numerous discussion contributions. The proceedings give a fairly complete up-to-date account of the state of national and regional glacier inventories, as well as guidance for the continuation of this task and for the further standardization of the data.
W86-03673

EAST-WEST AND NORTH-SOUTH SNOW LINE GRADIENTS IN THE NORTHERN PATAGONIAN ANDES, ARGENTINA,
Departamento de Recursos Naturales y Energia, San Carlos de Bariloche (Argentina).
J. Rabassa, S. Rubulis, and A. Brandani.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 1-10, 1 fig, 3 tab, 21 ref.

Descriptors: *Glaciers, *Glaciohydrology, *Argentina, *Snowline, *Climatology, Firn, *Glacier mass balance, *Hydrologic data collections, Snow surveys, Snow cover, Snow, History, Mountains, Data collections, Meteorologic data collection.

The snow line has been identified on the Argentine side of the northern Patagonian Andes. A definite trend is observed in both the east-west and the north-south snow line gradients. The snow line rises abruptly from the west (Chile) to the east (Patagonia), having progressively higher positions in the landscape since it remains above the summit of the higher peaks of the Sub-Andean ranges and Patagonian volcanoes. Similarly, the snow line descends steadily, although not so markedly, from north to south, favoring the conservation of cirque and valley glaciers at lower latitudes. The east-west gradients are caused by the interference of the humid winds from the Pacific with the Andean Cordillera. The north-south gradient is related to the lowering of mean annual temperatures away from the equator and also to the lower elevation of Andean peaks. For certain latitudes, present snow line gradients are compared with those from the Pleistocene. (Author)
W86-03674

GLACIERS AND GLACIOLITHIC SYSTEMS OF THE CENTRAL ANDES,
Instituto Argentino de Nivologia y Glaciologia, Mendoza.
A. E. Corte.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 11-24, 5 fig, 33 ref.

Descriptors: *Glaciers, *Andes, *Argentina, *Glaciohydrology, *Ice cover, Altitude, *Climatic data, *Glacial drift, *Moraines, Climatology, Glacial sediments, Precipitation.

A study of debris-covered glaciers and rock glaciers has been made within the context of the glacier inventory of the Mendoza River basin, Argentina. A relationship was identified between precipitation amounts and types of glacier activity. Covered ice is observed to be distributed in four altitudinal facies; thermokarst, structural debris, inactive rock glacier, and fossil ice rock glacier. Other types of glaciolithic systems included in the inventory were those of the talus type, ice-cored moraines located away from the uncovered ice and related to surging activity (ice under fast motion), and ice-cored moraines (lateral and frontal) related to slow ice motion. Debris cover varied from a few centimeters to many meters at lower altitudes. The sequence of four facies is explained as the result of four warm and cold phases of the Holocene. The ice formed during the last cold spell of the Little Ice Age (1450-1650) AD is being melted through the present thermokarst.
W86-03675

GLACIER INVENTORY OF BOLIVIA,
Hanover Univ. (Germany, F.R.).
E. Jordan, C. Brockman, A. Fernandez, R. Alvarez, and K. Jacobsen.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 25-32, 3 fig, 11 ref.

Descriptors: *Glaciers, *Glaciohydrology, *Glacier balance, *Bolivia, *Aerial photography, *Glacier mass balance, Tropical regions, Moraines, Hydrologic data collections, Satellite technology, Firn, Ablation.

A glacier inventory for Bolivia has been started. Since the whole territory of Bolivia is north of the southern tropic, glaciation is limited to the mountain peak regions of the Andes. The present glaciation is almost entirely limited to the northern part of the Cordillera Oriental. Glaciated areas, from north to south are the Cordillera de Apolobamba, the Cordillera Real of Illampu, the Tres Cruces, and the Santa Vera Cruz. Existing satellite and aerial maps of the glaciated area of Bolivia are of poor quality. Glacier inventory work is continuing in the southwestern part of the northern Cordillera Real and the Tres Cruces with aerial photography and an aerotriangulation method, respectively. Data about accumulation and ablation characteristics cannot be given for glaciers in the Tres Cruces and other tropic areas due to the temporal inhomo-

geneity of the aerial photos and daily variations in the mass balance of such glaciers.
W86-03676

INVENTORY OF CANADIAN GLACIERS: PROCEDURES, TECHNIQUES, PROGRESS AND APPLICATIONS,
Environmental Protection Service, Ottawa (Ontario).
C. S. L. Ommanney.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 35-44, 2 tab, 14 ref.

Descriptors: *Aerial photography, *Glaciers, *Data acquisition, *Hydrological data collections, Bibliographies, Data storage and retrieval, Computers, Glaciohydrology, Glaciology, Data transmission, Baseline data, *Canada, Hydrologic maps.

The procedures, techniques, progress and applications of the Canadian glacier inventory are reviewed. The Canadian program adhered strictly to the UNESCO system of glacier classification but added to it while keeping within the basic framework. Volumes have been determined for Axel Heiberg Island and Vancouver Island. Complete mapping aerial photography is available but the quality of maps varies considerably. Aerial photographs are examined using standard mirror or scanning stereoscopes. Features of work maps are color-coded. Glacier details from the work maps are used to compile the glacier index map. Data acquisition is handled by computer. Data is stored on magnetic tapes and a computerized bibliography system permits the retrieval of data through key words. A glacier archives exists but there is no acquisition program for it. The major constraint on progress of the Canadian glacier inventory has been the variable nature of the resource allocation. It is unlikely that Canada can complete this project within the time-frame suggested. The Canadian glacier inventory has already progressed too far to switch to the TTS system now being used by countries just starting glacier inventories. The Canadian glacier inventory has been used extensively by researchers, universities, and exploration groups.
W86-03677

HYDROLOGICAL BASINS IN WEST GREENLAND AND THEIR RELATIONSHIP TO A PRELIMINARY SECTORIAL DIVISION OF THE INLAND ICE SHEET,
Groelands Geologiske Undersoegelse, Copenhagen (Denmark).
A. Weidick.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 49-55, 4 fig, 4 ref.

Descriptors: *Glaciers, *Mapping, *Glaciohydrology, Ablation, *Ice cover, *Glacier mass balance, Hydrologic maps, *Water resources development, Firn, Glacier balance, Fjords, *Greenland.

A map of hydrological basins in West Greenland has been prepared by the Geological Survey of Greenland. The map serves to evaluate the freshwater potential of natural basins in west Greenland (especially with regard to future use of hydroloelectric power) and the western slope of the Inland Ice. The total amount of water to the West Greenland basins, including all precipitation, ablation of local glaciers and ablation and iceberg production of the western margin of the Inland Ice, is estimated to be 217 cu km/yr water equivalent. The altitude of the firn line, as estimated by aerial photographs, turned out to be very close to the position of the glaciation limit over the Inland Ice. Individual sectors of the Inland Ice have been defined by section division, and by construction of flowlines upstream at right angles to the contour lines. Sectors determined in this manner were not in complete agreement with regard to mass balance estimates of the individual sectors. However, the map furnishes an administrative, technical and scientific classification of natural basins to allow a fast reproduction of data relating to freshwater resources.
W86-03678

WEST GREENLAND OUTLET GLACIERS: AN INVENTORY OF THE MAJOR ICEBERG PRODUCERS,
Coast Guard Academy, New London, CT.
R. C. Kollmeyer.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 57-65, 6 fig, 1 tab, 3 ref.

Descriptors: *Glaciers, *Icebergs, *Floating ice, Glacial drift, Glaciology, Glaciohydrology, Ice cover, *Greenland, Ice, Fjords.

By an international treaty between 22 nations involved in North Atlantic shipping, the United States Coast Guard has been assigned a statutory mission to act as the International Ice Patrol. The International Ice Patrol was formed shortly after the iceberg sinking of the RMS Titanic. Ice Patrol duties include studies of the current conditions affecting the drift and persistence of icebergs in the North Atlantic Ocean and the glacial origin of the ice. In 1968 the US Coast Guard commenced an examination of the major iceberg producing glaciers along the west coast of Greenland. This program, called the West Greenland Glacier Survey, is attempting to visit and revisit every major outlet glacier along the western edge of the ice sheet. Terminus locations have been surveyed along with height measurements on 27 major outlet glaciers. A total of 59 glaciers have been photodocumented. Most of the glaciers exhibit retreat. (Author)
W86-03679

SOME PROBLEMS OF GLACIER INVENTORY IN THE HIMALAYAS,
C. P. Vohra.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 67-74, 1 fig, 1 tab, 4 ref.

Descriptors: *Glaciohydrology, *India, *Glaciers, *Aerial photography, *Satellite technology, Glaciology, Snowline, Moraines, Seismology, Mountains, River basins, Climatology, *Ice cover, *Himalayas, Geophysics.

Problems encountered in the pilot project undertaken by the Geological Survey of India in the Baspa River of the Indian Himalayas are discussed. The river basin has 89 glaciers and a glacierized area of 22% of the whole basin. The identification systems as defined in the UNESCO/IAHS guide and the Temporary Technical Secretariat guide (TTS) for compiling glacier inventories were not readily adaptable to the glaciers of India. Snowline data is usually obtained by ground parties but may be collected in the future by satellite. The topography of the Himalayas makes it difficult to estimate the equilibrium line. Aerial photographs by photogrammetry are not always accurate for determining glacier length. The accumulation area ratio should be easier to calculate with estimations of snowlines from satellite data and from careful study of aerial photographs. Geophysical methods such as seismic reflection and refraction and electrical resistivity are being used to determine mean glacier depth. Permanent snow/ice bodies on the valley walls often account for a considerable area of the basin. It is possible that the thick ice-covered moraines contribute significantly to the water discharges. The glacier inventory contributes to the study of the climate of the Himalayas.
W86-03680

PRESENT AND LATE PLEISTOCENE EQUILIBRIUM LINE ALTITUDES IN THE MT EVEREST REGION - AN APPLICATION OF THE GLACIER INVENTORY,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
F. Muller.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 75-94, 4 fig, 3 tab, 46 ref.

Descriptors: *Glaciology, *Glaciers, *Himalayas, *Precipitation, *Orography, *Snowline, Ablation, Air temperature, Mountains, Monsoons, Ice cover, Temperature, Glaciation, Cirques, Glaciohydrology.

UNESCO's pilot glacier inventory of the Mt. Everest area was extended to include some 450 glaciers. After evaluation of various methods to establish the ELA (equilibrium line altitude), the pattern of the ELA isolines was analyzed in relation to the orography, precipitation and temperature. The dominant role played by precipitation is recognized, and the unusually low mean AAR (accumulation and ablation relationship) value of 0.41 is explained. Based on the assumption that the elevations of the numerous empty cirques in the area represent the ELA at the time of their formation, a map and subsequently a comparative SSW-NNE profile of present and late Pleistocene ELAs was constructed. The difference between the two curves, only 100 m at the main crest and almost 600 m at the southern end, must be attributed, in part, to differential uplifting of the Mt. Everest area. After making allowance for this effect, the late Pleistocene temperature depression was estimated to be 4-5 degrees on the monsoon-affected Indian side and 2-3 degrees near the main mountain crest. It is concluded that the present pattern of monsoonal moisture supply also existed during late glacial times. Glaciation in the late Pleistocene was - as it is today - small in comparison to that of the other ice-prone parts of the globe. (Author)
W86-03681

GLACIER INVENTORY IN THE DUDH KOSI REGION, EAST NEPAL,
Nagoya Univ. (Japan). Water Research Inst.
K. Higuchi, H. Fushimi, T. Ohata, S. Takenaka, and S. Iwata.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 95-103, 5 fig, 2 tab, 15 ref.

Descriptors: *Glaciers, *Nepal, *Glaciology, *Glacial drift, *Glaciation, Glaciohydrology, Aerial photography, Hydrologic maps, Moraines, Ablation, Accumulation.

A glacier inventory was compiled of the Dudh Kosi region of East Nepal by field studies and aerial photographs in 1974-1976 as part of the Glaciological Expedition of Nepal (GEN). Glaciers in this region were classified as debris-covered or debris-free glaciers. Analysis of the GEN inventory showed that the lowest elevation of the debris-free glaciers in the basin of the Dudh Kosi tend to be higher in the sub-basin of the upper stream. The earlier Mueller (1979) inventory which used maps based on 1935-1963 terrestrial photogrammetry was compared with the GEN inventory. Differences between the lowest glacier elevations of debris-free glaciers in the GEN inventory and in the Mueller inventory indicate that variations in the glacier fronts during the peiod of approximately 1960-1975 had occurred. In the upper part of the study region, most of the debris-free glaciers during this time period were in retreat.
W86-03682

MATERIAL FOR A GLACIER INVENTORY OF THE INDUS DRAINAGE BASIN - THE NANGA PARBAT MASSIF,
W. Kick.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop ct Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 105-109, 2 fig, 9 ref.

Descriptors: *Glaciers, *India, *Glaciology, *Glaciation, *Hydrologic maps, Glaciohydrology, Mountains, Indus River basin, Data collections, Hydrologic data collections, Snow, Aerial photography, Satellite technology.

The local maps of India are for the most part inadequate for providing data needed for a glacier inventory of the Indus basin. One of the best local maps, that for the Nanga Parbat massif, was used as the basis for a glacier inventory in that area. The TTS identification system worked without difficulty when applied to the Indus drainage basin. Sixty-nine glaciers have been counted in the Nanga Parbat area; most of them are on the northern side mainly because of the relief. The climate is very arid in the lower regions but heavy snowfall in the higher altitudes causes very active glacerization which reaches down to pastures and fields, and even to areas of human settlement. The glaciers of Nanga Parbat cover 302 sq km and have an estimated volume of 25 cu km. Other sources for gathering glacier data (quarter-inch maps, aerial photographs, satellite images, etc.) should be spot checked against the results from the local maps before being generally used.
W86-03683

DISTRIBUTION, FEATURES AND VARIATIONS OF GLACIERS IN CHINA,
Academia Sinica, Lanzhou (China). Lanzhou Inst. of Glaciology and Cryopedology.
Y-F. Shih, T-C. Hsieh, P-H. Cheng , and C-C. Li.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 111-116, 2 fig, 1 tab, 2 ref.

Descriptors: *Glaciers, *Glaciology, *Glaciohydrology, *Hydrologic maps, *Glacial drift, Aerial photography, Precipitation, Snowline, Air temperature, Climatology, Spatial distribution, Glacier mass balance, *China.

Since 1975 a new glacier inventory is being made in China with new aerial and ground stereophotogrammetric maps. In Chilien Shan, Tien Shan, Altai and part of the Chinghai-Tibet Plateau there are 17,123 glaciers covering an area of 22,181 sq km. This represents roughly half of the glaciers in China. The new results show that the previous 1959 survey underestimated the number and the area of glaciers. Analysis of the spatial distribution of the snow line shows clearly the three main sources of precipitation. From the 1950's to 1960's glaciers were retreating but in the 1970's positive mass balances appeared and the snow line descended. Temperature has decreased and precipitation increased since the 1950's and, on the basis of dendroclimatological data, this trend may last until the end of the century with an increase of advancing glaciers. (Author)
W86-03684

RECENT RESEARCH ON GLACIERS ON THE CHINHAI-TIBET PLATEAU,
Academia Sinica, Lanzhou (China). Lanzhou Inst. of Glaciology and Cryopedology.
C-C. Li, and P-H. Cheng.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 121-127, 2 fig, 2 tab, 2 ref.

Descriptors: *Glaciers, *China, *Glaciology, *Glaciohydrology, *Monsoons, Glacial drift, Ice cover, Climatology, Air temperature.

Results of recent research on glaciers on the Chinghai-Tibet Plateau are briefly reviewed. Statistical and inventory work have been carried out in two main glacier areas, the Nyenchintangla Range and west Kunlun Shan, as well as in other areas. Development of glaciers on the plateau is greatly influenced by monsoons from the Indian Ocean. Glaciers can be classified as maritime or continental, the former being concentrated in west Scechuan, north Yunnan and southeast Tibet. Research on glacier fluctuations shows that the Little Ice Age was also experienced here with maxima occurring during the nineteenth century. This was followed by a strong retreat since the 1930's with recent signs of the initiation of a new period of glacier advance. (Author)
W86-03685

PROBLEMS AND RESULTS OF STUDIES OF MOUNTAIN GLACIERS IN THE SOVIET UNION,
Akademiya Nauk SSSR, Moscow.
V. M. Kotlyakov.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 129-137, 1 fig, 2 tab, 8 ref.

Descriptors: *Glaciers, *USSR, *Glaciology, *Glaciohydrology, *Firn, *Glacier surges, Glacier balance, Precipitation, Glacial drift, Alpine regions, Aerial photography, Satellite technology, Remote sensing, Cirques.

From 1965 to 1974, observations of heat, ice and water balances for the IHD program were carried out on seven selected mountain glacier basins of the USSR. The types of glaciers adopted in the glacier inventory of the USSR include: hanging, spill-over, slope, cirque, cirque-valley, hollow, simple-valley, compound valley, dendritic, expanded-foot, piedmont, conic summit glacier, and flat summit. The USSR glacier inventory serves as the primary source of data for the present study. The Kurowski method proved to be the best indirect method for calculating the firn line or equilibrium line. A glaciological method of calculating precipitation in the alpine zone, based on the concepts of Ahlmann and developed further by Krenke and Khodakov is described. Using this method, calculations were made on a small scale for the total territory of the USSR and in detail for the Pamirs and Caucasus. Results showed that the amount of precipitation, in particular solid precipitation, is far greater in the mountains than on the abutting plains and piedmonts. The inventory of surging glaciers of the USSR presents special dangers due to mudflows. Precise criteria for distinguishing surging glaciers from normal glaciers have not yet been worked out. Some data on glacier surges have been gained by remote sensing, aerial photography, and satellite observations.
W86-03686

STUDIES OF GLACIER FLUCTUATIONS IN THE USSR,
K. G. Makarevich.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 143-148, 3 tab, 13 ref.

Descriptors: *Glaciers, *USSR, *Glaciology, *Glaciohydrology, *Glacier surges, Glacier balance, Glaciation, Glacial drift, Ablation, Glacier mass balance, Firn, Hydrological data collections.

In the USSR, a new program of glacier variation surveys is being conducted which consists of three classes of observation. The annual full scale first-class observations should be carried out on specially chosen glaciers which are most suitable for modeling. The second-class observations (made periodically twice a year or once in several years) are aimed at obtaining the statistical characteristics of the changes occurring and an independent control of glacier fluctuations. The third-class observations should collect actual data for glacier fluctuations in a certain area and explain them by analyzing their interrelations with the help of mathematical models. The first-class observation program is subdivided into glaciological, glaciohydrological and glaciometeorological studies comprising 25 types of observations in all. A program of observation to identify surging glaciers has also been worked out.
W86-03687

SPECIAL PROBLEMS OF GLACIER INVENTORY IN AFGHANISTAN,
J. F. Schroder.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978.IAHS-AISH Publication No 126. 1980. p 149-154, 1 tab, 15 ref.

Descriptors: *Afghanistan, *Glaciers, *Glaciohydrology, *Glaciology, *Hydrologic maps, Glaciation, Hydrologic data collections, Remote sensing, Satellite technology, Mapping.

The physical features of Afghanistan make it difficult to complete a glacier inventory. Maps are difficult to obtain due to the political situation and American and Russian maps are often incompatible. Travel in many areas is either prohibited or very difficult. Many drainage basins have large man-made irrigation ditches that appear as dashed lines on maps. A preliminary mapping showed the general distribution of permanent ice and snow but was inadequate to give more than a general impression. Satellite imagery is being applied with some success to the study of glaciers in Afghanistan. The inventory work is proceeding in three large basins: Turkestan endorheic, Indus, and the Afghan-Iran plateau. A total of 1,207 glaciers have been inventoried so far.
W86-03688

PRESENT GLACIATION IN TURKEY,
Istanbul Univ. (Turkey).
A. Kurter, and K. Sungur.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 155-160, 3 tab.

Descriptors: *Glaciers, *Glaciation, *Turkey, *Glaciohydrology, Glaciology, Cirques, Snowline, Alpine regions, Aerial photography.

Glacier studies in Turkey have been difficult due to the lack of large scale topographical maps until recent times. Previous data on the lowest glacier elevations and the elevations of snow lines differ from author to author. Air photographs have recently become available. Three main groups of glaciers are found mainly in the eastern, northeastern, and southeastern parts of Turkey. The area in the eastern part of the Black Sea coastal ranges contains several glaciers longer than 1 km, the most famous of which is the Kackar Glacier. The second group in the Taurus ranges includes about two-thirds of the total number of glaciers in Turkey with several longer than 4 km. The most famous of the third group which consists of isolated extinct volcanic cones in the interior is the ice cap on Mount Agri (Ararat) with an area of 10 sq km. The valley glacier on the volcanic cone of Mount Erciyes is also well known.
W86-03689

SOME COMMENTS ON THE SWISS GLACIER INVENTORY,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
F. Muller, and K. Scherler.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 185-195, 3 fig, 16 ref.

Descriptors: *Glaciers, *Glaciology, *Glaciohydrology, *Switzerland, Snowline, Firn, *Hydrologic maps, Moraines, Ablation, Climatology, Hydrologic data collections, Glaciation.

The Swiss glacier inventory contains 1828 units over 1 ha in size with an average of 35 parameters each. It was recorded in accordance with the UNESCO/IAHS guidelines; however, instead of comparisons of firn line or ELA, the mapping of median glacier elevation is advocated. Experience with the Swiss inventory has clearly shown that snowline, firn line and ELA maps which are comparable over large areas, can only be achieved on the basis of assumptions which must be tested for each region through investigations. This requirement is beyond the scope of an inventory. The largest coherent ice masses occur in the highest chains: the Valais, the Bernese and the southern Grison Alps. Many smaller individual glaciers of various shapes and types are dispersed throughout the remaining parts of the area. The cumulative effect of the weather on a glacier is reflected by the altitude of the equilibrium line. The difference between the 1973 natural budget ELA and the altitude of the early September snow line is very small. The 1972/1973 budget year must be classed as a strongly negative one in terms of the accumulation area ratio (AAR). Snowline altitude for the

six major mountain groups varies by about 420 m. This variation is explained in terms of location and exposition to dominant winds and moisture supply. Further depth measurements using new radio echo-sounding equipment for temperate glaciers is in progress, to improve the volumetric data of the inventory.
W86-03690

MOUNTAIN GLACIERS IN THE MEDITERRANEAN AREA AND IN AFRICA,
Bern Univ. (Switzerland). Geographisches Inst.
B. Messerli.
In: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 197-211, 7 fig, 6 tab, 21 ref.

Descriptors: *Glaciers, *Glaciology, *Glaciohydrology, *Glaciation, *Snowline, Ice cover, Climatology, Mediterranean Sea, Alpine regions, Africa.

Few glaciers or glacierets still exist in the Mediterranean area. The snowline between the Alps and the mountains of North Africa and the Near East must be reconstructed with the help of climatic data. The only glaciers in Africa are on Mt. Kenya (covering an area of 0.8 sq km), on Kilimanjaro (5 sq km), and in the Ruwenzori (5 sq km). The median glacier elevation increases from the Ruwenzori (4680 m) to Mt. Kenya (4790 m) and to Kilimanjaro (5430 m). A retreat of the ice limits since the last century, or during the present one, can be reconstructed for the glaciers of the Mediterranean area and of East Africa. The climatic changes of the Mediterranean area are reflected in the conditions found for glaciers in the transition zone from a seasonal to a diurnal type of climate.
W86-03691

GLACIER SNOW LINE VARIATIONS IN THE SOUTHERN ALPS, NEW ZEALAND,
Ministry of Works and Development, Christchurch (New Zealand).
T. J. Chinn, and I. E. Whitehouse.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 219-228, 6 fig, 3 tab, 13 ref.

Descriptors: *Snowline, *Glaciers, *Glaciology, *Glaciohydrology, Glaciation, Alpine regions, *New Zealand, Precipitation, Spatial distribution.

End-of-summer glacial snowline elevation estimates have been made of several hundred glaciers over some 400 km of the Southern Alps from oblique photographs taken over the past two seasons. Aspect correction factors were applied to put all elevations in terms of south-facing glaciers. Accuracy is estimated at + or - 50 m, but by comparing photographs of successive years very small changes are detectable. The results show that the snowline elevations follow closely the precipitation distribution and exhibit a similar steep west-east gradient, together with a north-south gradient caused by latitude. The glacial snowline remains slightly below the 'glacial limit snowline' despite extensive glacial recession over the past century. Historical data indicate that over the past half-century glacial snowlines have generally undergone an accelerating increase in elevation which continued until the mid 1970's. (Author)
W86-03692

PROBLEM OF A GLACIER INVENTORY OF ANTARCTICA,
British Antarctic Survey, Cambridge (England).
C. Swithinbank.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 229-236, 4 fig, 8 ref.

Descriptors: *Glaciers, *Mapping, *Antarctica, *Glacioloy, Glaciohydrology, Polar regions, Antarctic, Ice cover, Ice thickness, Hydrologic maps, Glaciation, Remote sensing, Satellite technology, Aerial photography, Hydrologic data collections.

Only 19% of Antarctica has been mapped at the minimal scale of 1:250,000 required by the TTS instructions for glacier inventories. Only half the coastline has been mapped at the 1:250,000 scale. The largest scale at which the whole ice sheet has been mapped is 1:2,000,000. Even at this scale, some errors exist that are greater than 100 km. Satellite imagery will be useful for the mapping of Antarctica only if ground control equipment can be installed. The cost of using air photography for reconnaissance mapping of the remaining areas is likely to remain prohibitive for the remainder of the twentieth century. Large amounts of data have been collected on ice depth in Antarctica by radio echo-sounding techniques. The achievement of a 100-km spacing grid is limited only by the aircraft operating range and the availability of only one landing strip. Real advances in understanding the physical characteristics of the continent will only be achieved by successive approximations based on small scale 1:20,000,000 maps of ice surface elevation, ice thickness, bedrock elevation, accumulation rate, surface temperature, flowline spacing, balance velocity, strain rate, surface slope, basal shear stress, and basal temperature.
W86-03693

GLACIER BALANCES IN THE DRY VALLEYS AREA, VICTORIA LAND, ANTARCTICA,
Ministry of Works and Development, Christchurch (New Zealand).
T. J. Chinn.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 237-247, 4 fig, 3 tab, 12 ref.

Descriptors: *Glaciers, *Antarctic, *Glaciology, *Glaciohydrology, Glacier mass balance, Glacier balance, Snowline, Moraines, Ablation, Alpine regions, Sublimation, Glacial drift.

The glaciers of the Dry Valleys, a cold desert, occur in topographically favored positions in coastal and elevated areas where snow accumulation exceeds sublimation and other losses. Mass balance measurements have been made over a 6-yr-period on three glaciers (Jeremy Sykes, Alberich and Heimdall) and measurements of debris, snow accumulation, ablation and other parameters have been made of eight other glaciers. Measured mass changes are extremely small and indicate that all the glaciers are close to equilibrium although studies of marginal morphology and movement suggest that the glaciers are slowly expanding in readjustment to the post Pleistocene climatic amelioration. The glaciers carry very small loads of debris, largely as wind blown dust and sand carried in with drifting snow; consequently, recently constructed moraines are very limited in volume. One exception is the Taylor Glacier which carries large quantities of basal till. Extremely light snowfall occurring throughout the Dry Valleys allows wind to play the dominant role in governing the location of accumulation areas. Redeposited snow accumulating in valley heads and against steep slopes becomes the source of the majority of the alpine glaciers. Mass wasting from the glaciers is predominantly by sublimation, and meltwater is rarely seen above 1500 m altitude.
W86-03694

RECENT SECULAR VARIATIONS OF SNOW AND SEA ICE COVER,
Lamont-Doherty Geological Observatory, Palisades, NY.
G. J. Kukla, and J. Gavin.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 249-258, 7 fig, 2 tab, 10 ref. NSF ATM77-01062.

Descriptors: *Cryology, *Ice cover, *Snow cover, *Sea ice, *Satellite technology, Infrared imagery, Radiometry, Aerial photography, Seasonal variation, Snowpack, Polar regions, Arctic, Antarctic, Ice.

Recent seasonal and interannual variation of snow and ice cover has been observed in both hemispheres from 1967. Data was obtained by U. S. Navy and NOAA charts produced by satellite imagery. Mean extent of the snow and ice cover in the Northern Hemisphere and of pack ice around Antarctica peaked in 1972-1973. Snow was again extensive from late 1976 whereas pack ice in the Southern Hemisphere was close to the lowest levels observed by satellites between 1967 and March 1978. Snow cover area in autumn and sea ice area in spring displayed the largest variance. The changes were due mainly to earlier establishment of snow in autumn and later disappearance rather than to the changes of winter and summer extents. Except for the 1976-1977 seasons, the fluctuations of the surface extent of the cryosphere during the 11-yr-study period in both hemispheres seem to be generally in phase.
W86-03695

PARAMETERIZATION OF GLACIER EQUILIBRIUM LINE ALTITUDE,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
R. J. Braithwaite, and F. Muller.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 263-271, 4 tab, 23 ref.

Descriptors: *Glaciers, *Glaciology, *Orography, *Glacier mass balance, Glaciohydrology, Ablation, Glaciation, Glacier balance, Firn.

The equilibrium line altitude (ELA) is defined as the line separating the ablation area of a glacier from the accumulation area. Values for ELA are included in most glacier inventories; however, there are few glaciers whose ELA has been directly measured. ELA's are usually highly variable from year to year in comparison with their secular variations. A statistical analysis was made of mass balance and ELA time series for 33 glaciers. The steady state ELA was estimated for each glacier and its approximation in terms of simple and easily measured orometric parameters within the context of a glacier inventory was tested. In most cases, discrepancies of only a few decameters were found. For the purposes of a world glacier inventory, a theory relating equilibrium line altitude to climatic and orographic factors is required.
W86-03696

CAN THE LINEAR BALANCE MODEL BE EXTENDED TO THE WHOLE ALPS,
Laboratoire de Glaciologie et Geophysique de l'Environnement, Grenoble (France).
L. Reynaud.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 273-284, 8 fig, 2 tab, 9 ref.

Descriptors: *Glaciers, *Glaciology, *Glacier mass balance, *Hydrologic models, *Model studies, Temporal distribution, Alpine regions, Glaciohydrology, Statistical analysis, Glacier balance, Models, Mathematical models, Comparison studies, Climatology.

Mass balance series in the Alps were compared for 10 glaciers using the linear balance model of Liboutry to show similarity in the variations. The glaciers studied included 2 French, 4 Swiss, 3 Austrian, and 1 Italian glacier. The data collected on the 10 glaciers gave four sets: 2 glaciers (Aletsch and Sarennes from 1949-1977; 5 glaciers (Aletsch, Sarennes, Limmern, Hintereisferner and Kesselwandferner from 1953-1975); 8 glaciers (the previous plus St. Sorlin, Silvretta and Gries from 1961-1975); and 1 glacier (Careser Glacier plus the preceding with the Stubacher Sonnblickkees from 1967-1975). The variations each year between the glaciers was attributed to the different computations of balance used (hydrological; linear model, and direct measurement). Results indicated that for 1974 a great climatic difference existed between the French Alps and the rest of the Alps. To monitor these climatic variations more field work using the linear model is proposed. The centered balance variations were very similar for the differ-

ent series of comparison for all the other years studied.
W86-03697

ROCK GLACIERS: GLACIAL AND NON-GLACIAL ORIGINS,
Ottawa Univ. (Ontario). Dept. of Geography.
P. G. Johnson.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 285-293, 7 fig, 8 ref.

Descriptors: *Glaciers, *Rock glaciers, *Glaciology, *Talus, Avalanches, Glaciation, Glaciohydrology, Glacial drift.

The development of rock glaciers of glacial origin is dependent on the accumulation of sufficient surface detritus to protect the ice from melting over a long period of time. The term rock glacier has been widely applied to all major rock mass movement forms in alpine conditions without a true understanding of the flow mechanisms involved. Studies in the southwest Yukon Territory of Canada have shown that a number of mechanisms are involved in the formation of rock glaciers with a major difference between those of glacial and non-glacial origin. Glacial origin rock glaciers reflect the glacial history of an area while non-glacial rock glaciers are not directly related to glacier activity and their activity periods differ from the glacial-origin rock glaciers. Various origins of non-glacial rock glaciers have been proposed including snow avalanche origin, talus with inherited ice, and those with no ice content. For inclusion in the glacier inventory some distinction as to the type of rock glacier is essential in order to distinguish between glacier controls and periglacial (talus) controls.
W86-03698

CLIMATIC BACKGROUND TO SOME GLACIER FLUCTUATIONS,
Cooperative Inst. for Research in Environmental Science, Boulder, CO.
U. Radok.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 295-304, 8 fig, 18 ref.

Descriptors: *Climatology, *Glaciers, *Glacier mass balance, *Glacial drift, *Hydrologic models, Glaciology, Glaciohydrology, Glacier balance, Glaciation, Model studies, Models, Air temperature.

Glaciers reflect changes in climate through fluctuations in their net mass balance profiles. Early attempts at reconciling glacier fluctuations and net balance changes relied on Nye's kinematic wave model. The general recession of glaciers since the Little Ice Age has been examined with a dynamic glacier model proposed by Budd and Jenssen. The experimental reconstructions of net balance profiles by Kruss, Smith, and Allison which could account for the observed changes in several well documented glaciers in different climate regions are given. The results collectively point to a rise in mean temperature of less than 1 degree since the Little Ice Age.
W86-03699

EFFECT OF TOPOGRAPHIC ORIENTATION ON THE VARIATIONS OF GLACIER LENGTH,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
P. Kasser.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 305-311, 3 fig, 6 tab, 4 ref.

Descriptors: *Glaciers, *Topography, *Glaciology, *Statistical analysis, Alpine regions, Climatology, Geomorphology, Glaciation, Frequency distribution.

The relation between the length changes of glaciers and their orientation was investigated for the observation network of 115 glaciers in the Swiss Alps for seven years within the period 1946/1947-1976/1977. The number of glaciers diverging positively (+) and negatively (-) from the median value in their changes of length were counted and the ratio M(+/-) was tabulated for eight sectors of 90 degrees each, each sector being designated by its central direction. The glaciers in the central direction are counted with weight 1 while those in the two adjacent directions are added with weight 0.5. The maximum of M(+/-) is always in the northwest to northeast sectors, the minimum in the sectors southeast to southwest. This asymmetrical distribution is not due to climatic but to morphological factors, as is reflected in the inverse distribution of the sizes of glaciers in the network over the sectors. (Author)
W86-03700

USE OF THE DATA OF GLACIER INVENTORIES FOR COMPILATION OF THE WORLD ATLAS OF SNOW AND ICE RESOURCES,
Akademiya Nauk SSSR, Moscow.
N. N. Dreyer, and V. M. Kotlyakov.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 313-319, 2 tab, 5 ref.

Descriptors: *Glaciers, *Glaciology, *Hydrologic maps, *Glaciation, Glaciohydrology, Ice cover, Snow cover, Sea ice, Hydrologic data collections, Mapping.

The 'World Atlas of Snow and Ice Resources' covers all types of glacio-nival formations: snow cover, sea and river ice, ground ice and icings, ice sheets and mountain glaciers. The atlas is subdivided into 17 subject sections, of which the sections on glacier morphology and regime are the largest. The nature of coverage, contents, ways of depiction, and scales make it possible to unite all the maps of glacier morphology and regime into three groups. Large scale maps of separate glaciers show boundaries, firn line and snow cover, surface topography, transported and deposited till and hydrographic network. Mid-scale maps of morphological types of glaciers are prepared for mountain knots of glaciation. Small scale maps depict the properties of glacier systems in general. Glacier inventories serve as the main source for compiling the different scale maps. The inventory data used for the compilation of maps include: glacier name, the river flowing from the glacier, morphological type, general orientation, glacier length and area, glacier altitude, height of firn line, ablation area, and ice volume.
W86-03701

USE OF LANDSAT DIGITAL INFORMATION FOR ASSESSING GLACIER INVENTORY PARAMETERS,
Nebraska Univ. at Omaha. Remote Sensing Applications Lab.
D. C. Rundquist, S. G. Collins, R. B. Barnes, D. E. Bussom, and S. A. Samson.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 321-331, 3 fig, 1 tab, 16 ref.

Descriptors: *Satellite technology, *Glaciers, *Glaciology, *Ice cover, *Remote sensing, Aerial photography, Ablation, Computer programs, Glaciation, Moraines, Firn, Snow cover.

Traditional glacier inventory methods are both time consuming and costly, whether using direct field mapping or through interpretation of aerial photographs. The present study evaluates the potential for Landsat (MSS) digital information in analyzing the various components and characteristics of valley glaciers within a global framework as an alternative. Eight ice masses in four mountain areas of the world, Hindu Kush, St. Elias Range, Himalayas and Axel Heiberg Island, were examined in some detail with both single-channel thresholding and multispectral analysis of Landsat data. Experience with Landsat digital procedures indicates that the major surface features on larger valley glaciers can be properly identified and mapped. The accumulation and ablation zones can be differentiated well. The same pixel-radiance thresholds are applicable, with only minor modifications, to glaciers in close proximity to one another, otherwise substantial modifications are necessary. (Author)
W86-03702

SATELLITE IMAGE ATLAS OF GLACIERS,
Geological Survey, Reston, VA. Water Resources Div.
J. G. Ferrigno, and R. S. Williams.
IN: World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland, September 1978. IAHS-AISH Publication No 126. 1980. p 333-341, 4 fig, 20 ref.

Descriptors: *Satellite technology, *Hydrologic maps, *Glaciers, *Glaciology, Remote sensing, Mapping, Hydrologic data collections, Geography, Glaciohydrology, Antarctica, Greenland, Iceland, Maps.

The U.S. Geological Survey has initiated a project to prepare a satellite image atlas of glaciers with the cooperation of a number of U.S. and international organizations. The atlas will include the geographical distribution of glaciers as well as topics of glaciology and related environmental phenomena using Landsat, NOAA and other satellite data. The primary objectives of the atlas are to serve as an inventory of available images of extant glaciers, to show their scientific value, and to serve as the basis of Landsat image maps of glacierized areas. Examples of Landsat images from Antarctica, Greenland, Iceland, and Svalbard are given along with a brief discussion of some of the initial research with Landsat images in each area.
W86-03703

APPLIED CLIMATOLOGY.
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Geographisches Inst.
For primary bibliographic entry see Field 2B.
W86-03846

VIEW ON OUR KNOWLEDGE OF WATER RESOURCES IN RELATION TO CLIMATE IN THE ALPS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
For primary bibliographic entry see Field 2B.
W86-03847

DISCHARGE FORECASTING FROM GLACIERIZED AREAS TO OPTIMIZE HYDROELECTRIC POWER MANAGEMENT,
Grande Dixence Societe Anonyme, Sion (Switzerland).
For primary bibliographic entry see Field 8C.
W86-03848

REGIONAL WATER BALANCE IN THE MOUNTAINOUS ARCTIC AND ITS APPLICATION FOR WATER-RESOURCE PLANNING,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
For primary bibliographic entry see Field 2D.
W86-03849

2D. Evaporation and Transpiration

REGIONAL WATER BALANCE IN THE MOUNTAINOUS ARCTIC AND ITS APPLICATION FOR WATER-RESOURCE PLANNING,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
A. Ohmura.
IN: Applied Climatology, Proceedings of the 25th International Geographical Congress Symposium No 18: Applied Geography, 1984. p 67-77, 3 fig, 7 tab, 30 ref.

Descriptors: *Hydrologic budget, *Alpine regions, *Evaporation, Glaciers, Snowmelt, Planning, Climatology.

The natural cause for the fresh water shortage at arctic settlements is attributed to small precipitation and relatively large evaporation on the ground. Most of the annual evaporation takes place during the short snow-free period in summer, when the fresh water demand is high. During this period the evaporation exceeds precipitation at most arctic coastal settlements. It was found that in the western part of Axel Heiberg Island, N.W.T., the water balance on arctic tundra varies considerably with altitude, the precipitation exceeding the evaporation above 500 a.s.l. The specific runoff at altitudes between 500 and 800 m was found to be approximately 20 mm or 20,000 cu m discharge from 1 sq km drainage basin, which is sufficient to support a population of fifty at the current water consumption rate in the Canadian Arctic. As a second alternative the possibilty of tapping glacier melt water was investigated. The average specific runoff at altitudes between 500 and 800 m was found to be approximately 20 mm or 20,000 cu m discharge from 1 sq km drainage basin, which is sufficient to support a population of fifty at the current water consumption rate in the Canadian Arctic. As a second alternative the possibility of tapping glacier melt water was investigated. The average specific ablation in summer in the Queen Elizabeth Islands lies between 20 and 30 cm or 300,00 cu m discharge from a glacier of 1 cu km surface area, which meets the annual demand for a population of eight hundred. (Author)
W86-03849

2E. Streamflow and Runoff

EVALUATING THE USE OF DEPTH-FREQUENCY EQUATIONS FOR ENFORCING LOCAL FLOODPLAIN REGULATIONS,
Illinois State Water Survey Div., Champaign.
J. P. Lardner.
IN: Proceedings of a Conference on Management Techniques for Water and Related Resources, April 1984. p 131-142. 1 fig, 2 tab, 5 ref. Illinois University at Urbana-Champaign, Water Resources Center, October 1984, Special Report 14.

Descriptors: *Flood plain management, *Flood plains, *Flood frequency, Regional floods, Statistical analysis, Drainage area, Flood profiles, Catchment areas, Enforcement.

In Illinois the procedure used to estimate 100-year flood boundaries and prepare maps of flood-prone areas is the Depth and Frequency (D&F) Method. The purpose of this paper is to examine the variability of the D&F Method results when compared with detailed flood elevation data and to suggest ways to improve the accuracy of the D&F Method. Although this report shows the potential for serious error in flood depth calculation using the D&F Method, it remains the easiest and quickest tool to help planners, inspectors, and designers estimate flood depths where none exist. When used with discretion and good engineering judgement, the D&F Method has beneficial uses in providing a starting point toward arriving at a flood depth for a selected frequency at a given site. The most practical use occurs when errors in depth estimate will have minor consequence to those who use the results. In this analysis, differences between (a) depths predicted by the D&F Method versus those measured from profiles, and (b) the corresponding actual depth to predicted depth ratios were used to evaluate the D&F Method. Although the mean error of the D&F Method is acceptable (less than 1 foot, or 10% error) in parts of the state, the variability is high and unacceptable depths may result. Drainage area and slope show the most impact on flood depth at any given location. Use of rural and urban locations as a variable did not prove to be significant in predicting flood depths by the D&F Method. (Fazio-Omniplan)
W86-03450

HYDROLOGY OF AREA 1, EASTERN COAL PROVINCE, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
W. J. Herb, D. E. Brown, L. C. Shaw, and A. E. Becher.
USGS Water-Resources Investigation Report 83-223, 1983. 89 p, 74 fig, 27 tab, 34 ref.

Descriptors: *Hydrologic data, *Pennsylvania, Surface water, Groundwater, Water quality, Permits, *Acid-mine water, Biological communities, Metals, Flood peaks, Flow-duration curves, Water pollution effects, Eastern Coal Province, Susquehanna River basin, Public Law 95-87, Office of Surface Mining, Permit application, Energy, Bituminous coal, Benthic invertebrates, Bottom materials, Diversity index, Juniata River basin.

Hydrologic data are presented for Area 1 of the Eastern Coal Province, 7,400 square miles of the West Branch Susquehanna and upper Juniata River basins in west-central Pennsylvania. One hundred thirteen streams were sampled four times during the 1979 and 1980 water years for specific conductance, pH, acidity alkalinity, dissolved and total iron, dissolved and total manganese, dissolved sulfate, and dissolved solids. Benthic invertebrate populations were determined and bottom material samples were analyzed for metals. Fifty-five streams had pH, acidity, alkalinity, total-iron, total-manganese, and dissolved-sulfate levels indicative of acid-mine drainage. Streams in the top coal-producing counties generally had the lowest median pH, and highest median specific-conductance, dissolved-solids, total-iron, total-manganese, dissolved-sulfate, bed-material iron, and bed-material coal values in the area. These water-quality constituents were positively correlated with coal production except for pH which showed a negative correlation. Low-flow, mean-flow, peak-flow, and flow-duration statistics can be computed for gaged streams and estimated for ungaged streams. Median well yields in the area range from 5 to 50 gallons per minute, and ground water quality is suitable for most uses. (USGS)
W86-03547

STATISTICAL SUMMARIES OF STREAMFLOW DATA IN OREGON; VOLUME 1 EASTERN OREGON,
Geological Survey, Portland, OR. Water Resources Div.
J. Friday, and S. J. Miller.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Open-File Report 84-454, 1984. 150 p, 1 fig (map), 5 ref.

Descriptors: *Streamflow, *Statistical analyses, *Flow duration, *Flood recurrence interval, *Oregon, Annual flow statistics, Monthly flow statistics, Low flow, High flow.

Statistical summaries of streamflow data at 335 streamgaging sites are presented in this two volume report to aid in appraising the hydrology of river basins in Oregon. Records for 31 gaging stations were compiled into separate periods owing to changes in regulation during the period of data collection. The periods before and after regulation are presented for comparison. A brief station description is given describing the physical and operational features for each gaging station. Following the station description are tables of monthly and annual flow statistics, flood frequency data, low-flow and high-flow frequency data, and flow-duration information. (USGS)
W86-03550

STREAMFLOW AUGMENTATION AT FOSTERS BROOK, LONG ISLAND, NEW YORK - A HYDRAULIC FEASIBILITY STUDY,
Geological Survey, Syosset, NY. Water Resources Div.
For primary bibliographic entry see Field 4A.
W86-03551

FLOODS OF MARCH 1982, INDIANA, MICHIGAN, AND OHIO,
Geological Survey, Indianapolis, IN. Water Resources Div.
D. R. Glatfelter, G. K. Butch, and J. A. Stewart.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4201, 1984. 40 p, 30 fig, 1 tab, 7 ref.

Descriptors: Flood frequency, Flood hydrographs, Flood peak, *Floods, Indiana, Michigan, Ohio, *Rainfall, Regional floods, *Snowmelt, *Streams, *Surface runoff, Fort Wayne, Wabash River, St Joseph River, River Raisin, Maumee River, Kankakee River.

Rapid melting of a snowpack containing 2 to 6 inches of water equivalent coinciding with moderate rainfall caused flooding in March 1982 across northern Indiana, southern Michigan, and northwestern Ohio. Millions of dollars in property damage and the loss of four lives resulted from the flooding. Peak discharges at several gaging stations in each of the following river basins have recurrence intervals of 50 to greater than 100 years: Wabash, St. Joseph, River Raisin, Maumee, and Kankakee. Flooding in the Wabash River basin was confined to major tributaries draining from the north. The St. Joseph River experienced flooding having a recurrence interval of about 50 years. Peak discharges having recurrence intervals of 50 to greater than 100 years were recorded on the River Raisin. Flooding on most large streams in the Maumee River basin was the worst since 1913. The Kankakee River and its major tributary, Yellow River, recorded peak discharges having recurrence intervals greater than 100 years. Hydrologic data have been tabulated for 83 gaging stations and partial-record sites. Maps are presented to emphasize the severity and untimely sequence of meteorological conditions that provided the potential and triggered the floods. Hydrographs are shown for 32 gaging stations. (USGS)
W86-03552

HYDROLOGY AND LAND USE IN VAN BUREN COUNTY, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
T. R. Cummings, F. R. Twenter, and D. J. Holtschlag.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 84-4112, 1984. 124 p, 33 fig, 41 tab, 25 ref.

Descriptors: *Water quality, *Water utilization, *Land use, *Agriculture, Groundwater, Surface water, Geology, Irrigation, *Michigan, Van Buren County.

Van Buren County, in southwest Michigan, is drained by the Paw Paw and South Branch Black Rivers. The maximum discharge of the Paw Paw River is 2,500 cubic feet per second; the minimum is 202. Corresponding discharges of the South Branch Black River are 1,680 and 20 cubic feet per second. Dissolved-solids concentrations of strams and lakes range from 28 to 749 milligrams per liter. Total nitrogen concentrations as high as 15 milligrams per liter occurred at two stream sites. Glacial deposits, 100 to 600 feet thick, are sources of groundwater supplies. Irrigation wells are capable of yielding 1,000 gallons per minute. Model simulations are used to predict the effects of increased irrigation withdrawals. Dissolved-solids concentrations of ground water range from 112 to 878 milligrams per liter. Nitrate in water from 22 percent of the wells in the southern part of the county exceeded 10 milligrams per liter. Areal variations in the chemical characteristics of ground and surface water are related to land use and chemical inputs to the hydrologic system. Nitrogen input is 72.7 percent from fertilizer, 21.3 percent from precipitation, 4.5 percent from animal wastes, and 1.5 percent from septic tanks. (USGS)
W86-03554

RESULTS OF A SOLUTE TRANSPORT EXPERIMENT AT UVAS CREEK, SEPTEMBER 1972,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. J. Avanzino, G. W. Zellweger, V. C. Kennedy,

S. M. Zand, and K. E. Bencala.
USGS Open-File Report 84-236, 1984. 82 p, 40 fig, 9 tab, 5 ref.

Descriptors: *Solute transport, Experimental data, Chloride, Strontium, Sodium, *Adsorption, Streams, Low flow, *Environmental tracers, Santa Clara County, *California.

A 3-hour constant-rate injection of chloride, strontium, and sodium was made into Uvas Creek, Santa Clara County, California, to determine solute transport and sorption properties of a small stream. Seven observation stations were selected within a 635-m reach of the stream where water samples were collected before, during and after the injection. Size-sorted stream sediments placed in the stream prior to the injection were sampled to determine sediment sorption properties. Dissolved solute concentration data are presented in both original and normalized forms to illustrate the different transport properties of the three solutes. Sorbed concentrations are tabulated as a function of both time and grain size. Calculations of streamflow and sorptive distribution coefficient are given. (USGS)
W86-03556

TIME OF TRAVEL AND DISPERSION OF SOLUTES IN A 36.4-MILE REACH OF THE NORTH PLATTE RIVER DOWNSTREAM FROM CASPER, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
G. W. Armentrout , and L. R. Larson.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Water-Resources Investigation Report 82-4103, 1984. 17 p, 6 fig, 2 tab, 7 ref.

Descriptors: *Streamflow velocity, *Dispersion, *Dye releases, *Fluorescence, Salute transport, *Time of travel, North Platte River, *Wyoming, Casper.

Time-of-travel and dispersion measurements made during a dye study November 7-8, 1978, are presented for a reach of the North Platte River from Casper, Wyo., to a bridge 2 miles downstream from below the Dave Johnston Power Plant. Rhodamine WT dye was injected into the river at Casper, and the resultant dye cloud was traced by sampling as it moved downstream. Samples were taken in three equal-flow sections of the river's lateral transect at three sites, then analyzed in a fluorometer. The flow in the river was 940 cubic feet per second. The data consist of measured stream mileages and time, distance, and concentration graphs of the dye cloud. The peak concentration traveled through the reach in 24 hours, averaging 1.5 miles per hour; the leading edge took about 22 hours, averaging 1.7 miles per hour; and the trailing edge took 35 hours, averaging 1.0 mile per hour. Data from this study were compared with methods for estimating time of travel for a range of stream discharges. (different from 940 cubic feet per second.) (USGS)
W86-03559

WATER RESOURCES DATA, COLORADO, WATER YEAR 1981; VOLUME 3: DOLORES RIVER BASIN, GREEN RIVER BASIN, AND SAN JUAN RIVER BASIN.
Geological Survey, Lakewood, CO. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-124446, Price codes: A19 in paper copy, A01 in microfiche. Water-Data Report CO-81-3, 1982. 436 p, 6 fig, 4 tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analysis, Sediments, Water temperatures, Sampling sites, Water levels, Water analysis.

Water-resources data for Colorado for the 1981 water year consist of records of stage, discharge, and water quality of streams; stage, contents and water quality of lakes and reservoirs, and water levels and water quality of wells and springs. This report (Volumes 1, 2, and 3) contains discharge records for about 460 gaging stations, stage and contents of 22 lakes and reservoirs, 4 partial-record low-flow stations, 30 crest-stage partial-record stations, and 50 miscellaneous sites; water quality for 163 gaging stations and 300 miscellaneous sites; and water levels for 55 observation wells. A few pertinent stations in bordering States also are included in this report. The records were collected and computed by the Water Resources Division of the U.S. Geological Survey. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies. (USGS)
W86-03609

STORMWATER RUNOFF TREATMENT BY IMPOUNDMENT: BARRHAVEN PILOT STUDY,
For primary bibliographic entry see Field 5D.
W86-03632

USER'S MANUAL FOR EXPLORE-I: A RIVER BASIN WATER QUALITY MODEL, HYDRAULIC MODULE ONLY,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 2A.
W86-03646

STUDY OF THE HYDROCHEMICAL REGIME AND ITS LONG-TERM VARIATIONS IN THE CASE OF SOME RIVERS IN U.S.S.R.,
Hydrochemical Inst., Rostov-na-Donu (USSR).
For primary bibliographic entry see Field 2K.
W86-03778

SEPARATION OF RUNOFF COMPONENTS BY NO3-N LOADING AND ESTIMATION OF RUNOFF LOADING BY EACH COMPONENT,
National Inst. for Environmental Studies, Tsukuba (Japan).
For primary bibliographic entry see Field 5B.
W86-03788

PREPARING A DESIGN STORM,
Gore and Storrie Ltd., Toronto (Ontario).
For primary bibliographic entry see Field 2A.
W86-03833

CHIMNEY HILL OFF-SITE DRAINAGE STUDY,
MMM Design Group, Norfolk, VA.
For primary bibliographic entry see Field 2A.
W86-03835

2F. Groundwater

MODELING CHEMICAL REACTIONS AND TRANSPORT IN GROUNDWATER SYSTEMS: A REVIEW,
Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 5B.
W86-03428

GROUND-WATER CONDITIONS OF THE TRIASSIC AQUIFER IN DEAF SMITH AND SWISHER COUNTIES,
Texas Dept. of Water Resources, Austin.
G. I. Duffin.
LP-196, December 1984. 121 p, 14 fig, 5 tab, 25 ref.

Descriptors: *Groundwater, *Texas, *Aquifers, Well data, *Water quality, Radioactive wastes, Groundwater pollution, Stratigraphy, Structural geology, Groundwater movement, Groundwater recharge, Aquifer characteristics, Hydraulic profiles, Water level fluctuations, Water use, Test wells, Well logs, Chemical analysis, Unconfined aquifers, Confined aquifers.

In April 1984 the Texas Department of Water Resources initiated a study of the ground-water conditions of the Triassic aquifer in Deaf Smith and Swisher Counties. The need for the study was prompted by the Department of Energy's announcement that consideration was being given to locating high-level nuclear waste repository sites in these counties and by the concern over what impacts operation of such sites might have on the ground-water resources. Data gathered indicated that a limited number of water wells are completed in the Triassic aquifer. A comprehensive pumping test was conducted in Deaf Smith County using two wells completed in the Triassic aquifer. Results showed a well yield of 788 gallons per minute and an average transmissivity of 22,000 gallons per day per foot. These values should not be accepted as applying to the Triassic aquifer everywhere in the study area. Ground water in the Triassic aquifer occurs under both water-table and artesian conditions and water level measurements suggest that the potentiometric surface of the aqufier generally dips to the east and southeast. The chemical quality of ground water from Triassic aquifer wells that are used for municipal, irrigation, and domestic and livestock purposes ranges from fresh to slightly saline. No information was available on ground-water pumpage from industrial, irrigation, and domestic and livestock wells. However, during 1983 approximately 1,555 acre-ft of ground-water was pumped from the Triassic aquifer by the cities of Happy, Hereford and Tulia for municipal purposes. (Fazio-Omniplan)
W86-03439

INVESTIGATION OF THE FEASIBILITY OF SECONDARY RECOVERY OF GROUND WATER FROM THE OGALLALA AQUIFER: A REPORT TO THE SIXTY-EIGHTH LEGISLATURE.
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 3B.
W86-03442

GROUNDWATER CONTAMINATION AND EMERGENCY RESPONSE GUIDE,
Little (Arthur D.), Inc., Cambridge, MA.
For primary bibliographic entry see Field 5G.
W86-03457

MATHEMATICAL ANALYSIS OF GROUNDWATER RESOURCES,
Canterbury Univ., Christchurch (New Zealand). Dept. of Civil Engineering.
B. Hunt.
Butterworths Publishers, Boston. 1983. 271 p.

Descriptors: *Groundwater movement, *Mathematical studies, *Model studies, *Finite difference methods, Darcys law, Laplace equation, Aquifers, Boundary conditions, Saline water intrusion, Anisotropy, Confined aquifers, Computer programs, Unsteady flow, Transmissivity, Pumping tests, Steady flow, Groundwater pollution, Water pollution, Uniform flow, Nonuniform flow, Fate of pollutants, Water pollution sources, Hydrology, Schwarz-Christoffel transformation, Hydrographs, Recharge, Groundwater recharge, Wells.

A textbook on the use of mathematics to describe and solve problems in groundwater concentrates on finite-difference methods. Introductory material includes definitions, basic concepts, and derivation of partial differential equations of movement (e.g., Darcy's law) and several boundary conditions (e.g., seawater intrusion). Finite differences and computers are used to obtain approximate solutions of problems. Hele-Shaw experiments are used for problems with a free surface. The inverse problem, the problem of determining aquifer parameters for use in solving boundary-value problems, is discussed. Groundwater pollution topics include diffusion and dispersion, pollution sources in uniform flow, series expansions of the well function for leaky aquifers, and calculations in nonuniform flow. Complex variable theory is used to obtain exact solutions for two-dimensional, steady-flow problems. The Schwarz-Christoffel transformation maps the interior of regions bounded by straight lines into either an upper or lower half plane. Use of the Laplace transform is demonstrated in one-

dimensional examples, a groundwater recharge problem, well storage effect, and well recovery problems. (Cassar-PTT)
W86-03478

STUDIES ON GROUNDWATER TRANSPORT IN FRACTURED CRYSTALLINE ROCK UNDER CONTROLLED CONDITIONS USING NONRADIOACTIVE TRACERS,
Sveriges Geologiska Undersoekning, Uppsala.
E. Gustafsson, and C. E. Klockars.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-701952, Price codes: A04 in paper copy, A01 in microfiche. April 1981. 58 p, 19 fig, 14 tab, 26 ref.

Descriptors: *Tracers, *Groundwater movement, *Anions, *Crystalline rocks, *Fracture permeability, Ions, Environmental tracers, Boreholes, Geologic fractures, Permeability coefficient, Chromium, Nitrates, Iodine, Bromine, Rhodamine.

The hydraulic properties of rock mass and fractures, adsorptive properties of some selected tracers during transport along fractures, dispersivity and dilution of tracers during transport in fractures, and kinematic porosity of fractured bedrock were studied along existing fractures between two boreholes. Hydraulic tests and tracer experiments reveal that the studied fracture zone has a hydraulic conductivity of .002-.003 m/s, and its constituent main transport zones have a hydraulic conductivity of .003-.005 and .001-.002 m/s, respectively. Kinematic porosity is .0008-.0009, while the roughness factor is approximately 0.2. Estimations of fracture width give varying values depending upon the calculation method used. Water quantity calculations give approximately 20 times greater width than transport velocity calculations. Rhodamine WT shows a weak retardation and sorption compared with NO3(-) and I(-), while I(-), NO3(-), and Cr-EDTA appear to be comparable as nonreactive tracers. Br(-) exhibits lower recovery than NO3(-) and I(-). The natural occurrence of some ions may cause difficulties in interpreting results where the same ions are used as tracers. The tracer tests with radial flow show that the studied fracture zone consists of at least two transport pathways with different hydraulic chracteristics. The dispersivity of the two transport pathways is 0.9-1.2 m. The dilution of the tracer in the case of instantaneous injection is mainly dependent upon the flow geometry and less on dispersion and dilution in the pump well. (Geiger-PTT)
W86-03497

STOCHASTIC-CONVECTIVE ENSEMBLE METHOD FOR REPRESENTING DISPERSIVE TRANSPORT IN GROUNDWATER,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5B.
W86-03498

HYDROCHEMICAL AND ISOTOPIC CONTENT OF BASALT GROUNDWATERS BENEATH THE HANFORD SITE, WASHINGTON,
Rockwell International, Richland, WA. Energy Systems Group.
For primary bibliographic entry see Field 2K.
W86-03517

GROUND WATER IN CARBONATE ROCKS AND REGOLITH IN THE FAIRVIEW AREA, TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
C. R. Burchett, A. Zurawski, A. K. Sparkes, and E. F. Hollyday.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4134, 1983. 38 p, 18 fig, 5 tab, 17 ref.

Descriptors: *Geohydrology, *Well data, *Groundwater, Groundwater availability, Carbonate rocks, *Tennessee, *Williamson County, Western Highland Rim, Mississippian carbonates.

Fourteen test wells drilled in the Fairview area, Tennessee, produce from 3 to 100 gallons per minute and have an average yield of 32 gallons per minute, measured while blowing water from the wells with compressed air. In comparison, the average yield of supply wells reported by drillers is 13 gallons per minute. Specific capacities for three of the test wells ranged from 0.3 to 0.6 gallons per minute per foot of drawdown after 8 hours of pumping at 20 to 47 gallons per minute. Two test wells had specific capacities of 1.1 and 0.4 gallons per foot of drawdown after 72 hours of pumping at 55 and 43 gallons per minute. The mineral content of ground water increases greatly below a gypsum horizon approximately 100 feet below the top of the Fort Payne Formation. Ground water above the gypsum horizon, however, meets the standards for finished drinking water. (USGS)
W86-03548

GROUND-WATER LEVELS IN ARKANSAS, SPRING 1984,
Geological Survey, Little Rock, AR. Water Resources Div.
J. Edds.
Price codes: A04 in paper copy, A01 in microfiche. USGS Open-File Report 84-711, 1984. 58 p, 4 fig, 15 tab, 18 ref.

Descriptors: *Groundwater level, *Aquifers, Well hydrographs, *Arkansas, *Alluvial aquifer, Sparta Sand.

This report contains about 680 ground-water level measurements made in observation wells in Arkansas in the spring of 1984. In addition, the report contains well hydrographs relating to the alluvial aquifer and the Sparta Sand and Memphis Sand aquifers, the most important aquifers with respect to ground-water availability and use in Arkansas. (USGS)
W86-03553

HYDROLOGY AND LAND USE IN VAN BUREN COUNTY, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03554

HYDROGEOLOGIC DATA FROM A TEST WELL AT KATHRYN ABBEY HANNA PARK, CITY OF JACKSONVILLE, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
D. P. Brown, R. A. Johnson, and J. S. Baker.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-143, 1984. 41 p, 19 fig, 6 tab, 3 ref.

Descriptors: *Observation well, *Groundwater, *Subsurface investigations, Saline-water intrusion, Confined aquifers, Hydrogeology, Well logging, *Florida, Duval County, City of Jacksonville, *Floridan aquifer.

A 2,026-foot test well was drilled at Hanna Park, City of Jacksonville, Florida, to obtain hydrogeologic data. Drill cuttings and water samples were collected, and water-level measurements and lithologic and geophysical logs were made. The well is constructed with 6-inch diameter casing from land surface to a depth of 1,892 feet and cement grouted in place. The remainder is open hole. The uppermost 411 feet of material penetrated by the well consists of sand, clayey sand, phosphatic sandy clay, coquina, sandy limestone, and dolostone. In the remainder of the hole, the material consists of limestone and dolostone, which comprise the Floridan aquifer in the area. (USGS)
W86-03555

GEOLOGIC AND HYDROLOGIC DATA FROM A TEST-DRILLING PROGRAM IN THE HIGH PLAINS AREAS OF SOUTH DAKOTA, 1979-1980,
Geological Survey, Rapid City, SD. Water Resources Div.
C. L. Loskot, H. L. Case , and D. C. Hern.
Available from OFSS, USGS, Box 25425, Lakewood, CO 80225. USGS Open-File Report 84-148, 1984. 31 p, 2 fig, 1 tab, 2 ref.

Descriptors: *Drillers logs, *Drilling samples, Test holes, Aquifers, Electrical well logging, *South Dakota, *High Plains, *Ogallala Formation, *Arikaree Formation, White River Group, Rosebud Reservation, Pine Ridge Reservation.

The High Plains aquifer system in south-central South Dakota comprises dune sands, the Ogallala Formation, the Arikaree Formation, and the White River Group. As part of the High Plains Regional Aquifer-Systems Analysis, a total of 29 test holes were drilled from 1979 to 1980 to aid in defining the geometry of the aquifer system. The information obtained from these drilling progrms is presented. (USGS)
W86-03558

CHALLENGES IN AFRICAN HYDROLOGY AND WATER RESOURCES: PROCEEDINGS OF THE HARARE SYMPOSIUM,
Ministry of Water Development, Salisbury (Zimbabwe).
July 1984. IAHS Publication No. 144, 1984. Edited by D. E. Walling, S. S. D. Foster, and P. Wurzel. 587 p.

Descriptors: *Water resources development, *Groundwater, *Erosion control, *Erosion, *Sedimentation, Sediment yield, Soil conservation, Water supply, Exploration, Geohydrology, Aquifers, Africa, Isotope studies, Recharge, Model studies, Data collections, Conservation, Sediment transport, Soil erosion, Agriculture, Soil loss.

Drought, rural development, and soil erosion are some of the problems faced in Zimbabwe and other African nations. This symposium explores problems and solutions in the areas of groundwater development and soil erosion. Papers concerning groundwater include basic data on groundwater resources in the basement shield, sedimentary basins, and volcanic terrains; use of isotopes and models; and data aquisition and archiving of information. Although groundwater resources are adequate in many areas, many have not been developed. Artificial recharge and conjunctive use have been explored. Soil erosion and sediment yield measurements are given for Africa as a whole and for specific locations. Measurement and prediction techniques for soil erosion are described. The assessment and control of soil erosion problems in agricultural lands and at mining sites are discussed. Studies on reservoir sedimentation show how to predict and extend the useful life of a reservoir by proper design, reservoir management, and flushing.
W86-03562

AFRICAN GROUNDWATER DEVELOPMENT-THE CHALLENGES FOR HYDROGEOLOGICAL SCIENCE,
British Geological Survey, Wallingford (England).
S. S. D. Foster.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 3-12, 3 fig, 5 ref.

Descriptors: *Groundwater potential, *Water resources development, Water management, *Water supply, *Exploration, *Geohydrology, Wells, Aquifers, Groundwater hydrology, Hydrology, Africa, Boreholes, Drilling, Economic aspects, Water demand, Regoliths, Groundwater mining, Recharge, Groundwater recharge.

Groundwater has many advantages for water supply development in Africa. The principal hydrogeological problems associated with groundwater development are (1) inhomogeneity of many minor aquifers, resulting in difficulty in well siting, (2) estimation of resources for large-scale development, and (3) the presence of unacceptable inorganic substances in some aquifers. Economic constraints are a major factor retarding groundwater development in Africa. Each of the three principal African geohydrological areas (basement shield,

sedimentary basins, and volcanic terrains) are characterized by different groundwater potential and by distinct exploration, evaluation, development, and management problems. In the basement shield two basic aquifers are developed: the weathered mantle (regolith) and the fractured basement rocks (bedrock). The regolith is less expensive to develop for small water supplies. More data is needed for developing larger supplies in the basement rocks. The sedimentary basins contain enormous volumes of water in storage. However, exploration is needed to allow effective borehole siting. Since some of this resource is fossil water, the extent of groundwater mining must be determined. Volcanic terrains have extremely variable aquifer occurrence, potential, and chemical quality. Exploration costs are expected to be higher than in the other hydrogeological regions. Practical issues to be considered in groundwater development are engineering aspects, protection from pollution, and artificial recharge. A national archives for borehole drilling records can serve as a reference for exploration and ultimately reduce costs.
W86-03563

GROUNDWATER RESOURCES IN TROPICAL AFRICAN REGOLITHS,
Ife Univ. (Nigeria). Dept. of Geography.
E. O. Omorinbola.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 15-23, 2 fig, 2 tab, 20 ref.

Descriptors: *Groundwater potential, *Water resources development, *Water management, *Exploration, *Geohydrology, *Wells, *Aquifers, Groundwater hydrology, Hydrology, Nigeria, Boreholes, Drilling, Regoliths, Tropical regions.

A direct method for quantitative groundwater evaluation in the tropical African regoliths is suggested. It requires reliable information on the following hydrogeological parameters: the spatial pattern or mode of occurrence of the zone of saturation, the mean thickness of the zone of saturation, the porosity and specific yield of the saturated material, and the size or areal extent of the area under investigation. The method is illustrated in applications to three areas in Nigeria. Calculations show that in these areas (Middle Osun Valley, Upper Oba Basin, and Ilorin southeast) 50-60% of the total groundwater is available for use, providing a perennial, high yield supply. Advantages of the direct method over indirect methods are as follows: (1) it uses data on essential hydrogeological parameters of the regoliths and offers opportunity of explaining the nature of groundwater storage in a given regolith, (2) groundwater resources in deep basins of decomposition can be readily included in the quantity of total and drainable groundwater storage, (3) the data required by the method can be statistically analyzed to provide further information, (4) the method can be applied at any time of the year and is not restricted to drainage basins, (5) information derived from the method can contribute to high success rates for wells, and (6) it helps to prevent overabstraction.
W86-03564

CHARACTER OF FRACTURED ROCK AQUIFERS IN EASTERN BOTSWANA,
British Geological Survey, Wallingford (England).
D. K. Buckley, and P. Zeil.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984 IAHS Publication No. 144, 1984. p 25-36, 8 fig, 5 ref.

Descriptors: *Groundwater potential, *Water resources development, *Exploration, *Water supply, *Geohydrology, *Wells, *Aquifers, Groundwater hydrology, Hydrology, Botswana, Boreholes, Drilling, Geologic fractures, Channel aquifers.

Hydrogeological studies for village water supply from basement rocks in eastern Botswana show that groundwater occurrence is restricted to linear structural features associated with faulting and intrusion. The fractured aquifer which develops in this situation is characteristicaly channel-shaped of large length and narrow width and is best regarded as a vertical feature rather than a horizontal one. The most promising location for borehole sites has proved to be at the major intersections of the separate channels. Standard exploration techniques can be used to identify these channel aquifers and a combination of magnetometer and resistivity methods proved useful to locate successful sites. Particular challenges faced by the hydrogeologist working with these aquifers lie in locating suitable structures, estimating possible recharge and analyzing the aquifer response to pumping. (Author)
W86-03565

ESTIMATING GROUNDWATER RECHARGE BASED ON INFILTRATION CHARACTERISTICS OF LAYERED SOIL,
National Sugar Research Station, Kisumu (Kenya).
J. Singh, W. W. Wapakala, and P. K. Chebosi.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 37-45, 5 fig, 3 tab, 12 ref.

Descriptors: *Groundwater recharge, *Recharge, *Infiltration, *Rainfall, Kenya, Excess rainfall, Evaporation, Soil water, Soil horizons.

The infiltration characteristics of three soil horizons at the National Sugar Research Station, Kenya, were measured by use of concentric 1.5-m and 2.4-m squares constructed of galvanized iron sheets, placed at depths of 30 cm. The constants of the Horton, Philip and Kostiakov equations were determined by the method of least squares. The rainfall and pan evaporation data were analyzed to determine periods of excess rainfall, and the relation between rainfall intensity and duration. Soil moisture data indicated the depth of water needed to fill the void spaces and initiate groundwater recharge. The groundwater recharge was estimated by application of Horton's equation for periods when rainstorms exceeding 10 mm fell on two or more consecutive days during April-June; in 1983 it was estimated to be about 55 mm. (Author)
W86-03566

SOME CRITICAL ISSUES WITH MONITORING CRYSTALLINE ROCK AQUIFERS FOR GROUNDWATER MANAGEMENT IN RURAL AREAS,
Prakla-Seismos Geomechanik, Accra (Ghana).
R. R. Bannerman, and N. B. Ayibotele.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 47-56, 3 fig, 4 ref.

Descriptors: *Groundwater management, *Network design, *Water management, *Exploration, *Geohydrology, *Wells, *Aquifers, *Monitoring, Groundwater hydrology, Hydrology, Ghana, Boreholes, Drilling, Rural areas, Pumping.

A groundwater monitoring network was established in Ghana, using a sample of production boreholes instead of the usual observation wells, drilled at extra cost. Fifty-three boreholes were selected to form the network, about 2% of the number of production boreholes. Aquifers in this region have low transmissivities and low storativities. Being heterogeneous, the aquifers have variable hydraulic characteristics over short distances and little interbasin exchange. It was shown that the groundwater regime in this crystalline rock region was largely under the influence of the rainfall regime. Although about 2500 wells were installed, most fitted with hand pumps, they had no apparent adverse effect on groundwater levels. This was a result of the small withdrawals.
W86-03567

CHARACTERISTICS OF THE WEATHERED BASEMENT AQUIFER IN MALAWI IN RELATION TO RURAL WATER SUPPLIES,
British Geological Survey, Wallingford (England).
P. J. Chilton, and A. K. Smith-Carington.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 57-72, 5 fig, 4 tab, 9 ref.

Descriptors: *Groundwater, *Water quality, *Exploration, *Geohydrology, *Wells, *Aquifers, *Water supply, Groundwater hydrology, Hydrology, Malawi, Boreholes, Drilling, Recharge, Groundwater recharge, Rural areas.

Prolonged weathering of crystalline Basement Complex rocks in Central Africa has produced a layer of unconsolidated material which forms an extensive but relatively thin aquifer of low permeability. This is an important source of rural water supplies in Malawi. Potential yields are low, but the 0.25-0.5 liter per second required for hand pumps can be widely obtained where the saturated thickness is more than 10 m. Although the aquifer is fairly extensive, on a local scale, differences in bedrock mineralogy and structure produce significant variations in its physical and chemical characteristics. The distribution of permeability within the aquifer and its relationship to the fluctuating water table are important in determining the drought reliability of the aquifer. Occurrences of poor quality groundwater affect the acceptability of the water supplies and the costs of rural water supply projects. There are difficulties in estimating recharge to the weathered basement aquifer, but even at complete water supply coverage for the rural population the abstraction is only a small proportion of the annual recharge. (Author)
W86-03568

ELECTRIC LOGS FOR GROUNDWATER EXPLORATION IN THE NIGER DELTA.
Ilorin Univ. (Nigeria). Dept. of Geology.
A. U. Oteri.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 87-94, 5 fig, 1 tab, 13 ref.

Descriptors: *Groundwater potential, *Exploration, *Electrical studies, *Water supply, *Water quality, *Geohydrology, *Wells, *Aquifers, *Boreholes, Niger Delta, Brackish water, Saline water, Confined aquifers, Deep aquifers, Shallow aquifers, Geophysics, Oil wells.

The riverine ara of the Niger Delta, Nigeria's major oil producing area, is a broad belt of saline/brackish mangrove swamps riddled by meandering tidal creeks. Provision of potable water in this area has been a major problem, despite the heavy annual rainfall of over 3000 mm. The development of groundwater resources is the only alternative to the present inadequate system, which relies on collected rainwater. Fresh water in the area occurs in shallow unconfined aquifers in beach ridges and tidal point bars along creeks and/or in deep confined aquifers. Most boreholes drilled to date have encountered brackish water due to inadequate hydrogeological feasibility studies. A study of electric logs from oil wells is shown to be a feasible exploration tool for deep aquifers. This is supplemented by geoelectrical surveys for shallow aquifers in the areas not logged by oil companies. (Author)
W86-03570

WATER RESOURCES ASSESSMENT STUDY IN KIAMBU DISTRICT, KENYA,
Dienst Grondwaterverkenning TNO, Delft (Netherlands).
J. P. Heederik, N. Gathuru, F. I. Majanga, and P. G. Van Dongen.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 95-110, 10 fig, 5 tab, 5 ref.

Descriptors: *Groundwater, *Geohydrology, *Groundwater potential, Model studies, Kenya, Hydrologic budget, Boreholes.

Groundwater resources were investigated in a 300-sq mile area west of Nairobi, Kenya. The present public water supply consists of 8 boreholes and a piped gravity system. In addition, there are pri-

vately owned boreholes. The district is an almost closed basin with internal drainage. Volcanic formations form nearly the whole area. The volcanic rocks do not transmit water. The weathered fault and fractured zones are the main water transmitters. Sedimentary horizons between impervious layers provide cross connections. Four groundwater zones exist: eastern boundary (many perennial springs feeding small streams); highlands (high transmissivity, along faults, groundwater at depths of 50-100 m); western grazing area (very low transmissivity, groundwater at depths of 150-200 m); and Rift Valley floor (groundwater at depths exceeding 320 m). Groundwater recharge (100 mm for the eastern part and 60 mm for the western part) was estimated from a surface water balance based on simplified assumptions for the actual evapotranspiration. A steady-state numerical-difference flownet analysis was used to calculate the groundwater balance.
W86-03571

ISOTOPE STUDIES AS A FINAL STAGE IN GROUNDWATER INVESTIGATIONS ON THE AFRICAN SHIELD,
Vrije Univ., Amsterdam (Netherlands). Inst. voor Aardwetenschappen.
W. Geirnaert, M. Groen, J. Van Der Sommen, and A. Leusink.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 141-153, 8 fig, 1 tab, 3 ref.

Descriptors: *Groundwater, *Geohydrology, *Isotope studies, *Recharge, *Exploration, Groundwater recharge, Upper Volta, Radioisotopes, Carbon radioisotopes, Deuterium, Tritium, Oxygen isotopes, Natural recharge, Groundwater dating, Dating.

Isotopes were used to study geohydrology in Upper Volta, where limited observation wells are available. In general, little evaporation occurs prior to infiltration. Recharge takes place only during heavy showers. In areas with a thick weathered zone no recent recharge was observed. Carbon-14 determination in these wells gave a water age of 2000-3000 years. However, such determinations are not as dependable where calcium carbonate solution and silicate weathering are common. Application of the isotope methods to specific cases showed that at Bousse, groundwater extraction is essentially a mining operation. At Djibo, located near a lake, direct recharge occurs close to the lake and diminishes further from the lake.
W86-03574

ISOTOPES IN GROUNDWATER HYDROLOGY,
BKH Consulting Engineers, The Hague (Netherlands).
J. L. Terwey.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 155-160, 2 fig, 1 tab, 5 ref.

Descriptors: *Groundwater, *Hydrology, *Geohydrology, *Isotope studies, Groundwater dating, Dating, Oxygen isotopes, Carbon radioisotopes, Aquifers, Deuterium, Tritium, Recharge, Groundwater recharge.

Stable and radioactive isotopes were used to study groundwater hydrology in the Sudan. A groundwater sample from a well near the White Nile and from the river itself had a similar isotopic composition, indicating recent recharge. Another sample taken at a considerable distance from the Blue Nile had very low isotopic values, indicating a groundwater age of 15,000 years.
W86-03575

ENVIRONMENTAL ISOTOPE HYDROLOGY IN SOUTHERN AFRICA,
University of the Witwatersrand, Johannesburg (South Africa).
B. T. Verhagen.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 161-174, 6 fig, 22 ref.

Descriptors: *Groundwater, *Geohydrology, *Isotope studies, *Groundwater recharge, *Recharge, *Mine water, Infiltration, Fate of pollutants, Water pollution sources, Africa, Carbon radioisotoeps, Oxygen isotopes, Serowe, Botswana, Dewatering, Kalahari.

Increasing use of isotope hydrological studies in southern Africa is a result of growing expertise. At Serowe, the largest traditional village in Botswana, isotope studies revealed that recharge was more general and more recent than previously assumed. Tritium analyses at a few boreholes showed that the water in certain areas was under immediate threat of bacterial and chemical pollution. Iron mines at Sishen were flooded during exceptionally heavy rains, necessitating increased dewatering activity. A major dyke divides the mine into northern and southern sections. Isotope studies showed that water from the north mine was several thousand years old; that in the south mine was derived from the recent floods. Seepage water from a diamond mine, being used for a domestic supply, suddenly showed pH levels of 9-10. Although sodium hexametaphosphate descaling agent was first blamed forthe pH rise, isotope studies showed that the high pH was actually the result of contact with freshly fractured kimberlite. Isotopes were also used to investigate the hydrology of the Kalahari, particularly the association of groundwater with surface water and the implications of local recharge.
W86-03576

GROUNDWATER MANAGEMENT BY MEANS OF A QUASI-THREE-DIMENSIONAL FINITE ELEMENT FLOW MODEL,
G. Pizzi, and L. Sartori.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 175-184, 9 fig, 1 tab, 4 ref.

Descriptors: *Groundwater management, *Groundwater availability, *Geohydrology, Water management, *Model studies, IGROSS model, Computer programs, Mathematical models, Libya, Finite element method.

IGROSS (International Groundwater Systems Simulation) is an industrial system of digital programs specially designed for multi-aquifer groundwater systems simulation, and is based on the quasi-three-dimensional finite element approach. The system of computer programs is modular, and the different programs are linked by means of auxiliary data files. The model of the western Libya regional groundwater system is presented as a relevant application of IGROSS. The aquifer system concerned extends over 800,000 sq km and is composed of four aquifers hydraulically interconnected both along aquifer branchings and through interbedded aquitards. The model has been calibrated in a steady and an unsteady state; subsequently 10 simulations have been run until the year 2030. (Author)
W86-03577

ROLE OF MODELING IN THE DEVELOPMENT OF AFRICAN GROUNDWATER RESOURCES,
W. I. M. Elderhorst.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 185-191, 5 fig, 8 ref.

Descriptors: *Groundwater, *Geohydrology, *Model studies, *Water resources development, Exploration, Africa, Mathematical models.

Numerical modeling can find widespread application in Africa. For most projects in rural areas, it is sufficient to use a two-dimensional, single aquifer model without considering unsaturated zone interaction and groundwater density difference. First attempts to model a given area should use no more than 50 elements in the network. Square and rectangular elements are easiest to handle, but triangular and polygonal elements often are more suitable for a network of wells. Groundwater modeling should be an integral part of the entire water resources development project.
W86-03578

WATER RESOURCES DATA, COLORADO, WATER YEAR 1981; VOLUME 3: DOLORES RIVER BASIN, GREEN RIVER BASIN, AND SAN JUAN RIVER BASIN.
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03609

CONSEQUENCE ASSESSMENT OF HYDROLOGICAL COMMUNICATIONS THROUGH BOREHOLE PLUGS,
INTERA Technologies, Inc., Houston, TX.
For primary bibliographic entry see Field 5G.
W86-03629

ROLE OF NATURAL ORGANICS ON WATER INTERACTION WITH SOIL AND ROCK,
Kiel Univ. (Germany, F.R.).
For primary bibliographic entry see Field 2K.
W86-03754

HYDROGEOCHEMICAL EVOLUTION AND VARIABILITY OF GROUNDWATER IN EXPERIMENTAL BASINS OF S. W. WESTERN AUSTRALIA,
J. V. Turner.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 41-54, 6 fig, 1 tab, 14 ref.

Descriptors: Spatial distribution, Temporal distribution, *Geohydrology, *Aeration zone, *Groundwater basins, *Groundwater recharge, *Hydrologic cycle, *Geochemistry, Groundwater, Water quality, Infiltration, Silicates, Australia, Weathering, Cation exchange, Water chemistry.

Spatial and temporal variations in the hydrogeochemical characteristics of groundwater are of interest both in terms of the evolution of water quality and because they are indicative of a range of processes that occur in the hydrologic cycle. These interacting processes include the hydrogeochemical evolution during infiltration of rainfall through the unsaturated zone, solute concentration by evapotranspiration and eventual recharge to groundwater. In the saturated zone hydrogeochemical variability may be attenuated or persist, depending on the flow characteristics and geochemical processes that occur in the saturated medium. A case study involving three experimental basins in the southwest of Western Australia is used in an attempt to identify the principal hydrogeochemical and hydrologic processes which interact to produce spatial variability in groundwater ionic composition on a basin scale. It is found that temporal variability in hydrogeochemistry of unpumped bores is minor over a period of ten years. The principal hydrogeochemical processes leading to spatial variability in groundwater were found to be cation exchange and chemical weathering of primary silicates in the unsaturated zone. It was also necessary to consider both the gaseous atmosphere and mineralogy of the unsaturated zone, the water flux through the unsaturated zone and the rate of recharge to groundwater. Interpretations were assisted by a similar and relatively uniform mineralogy in the basins studied. (Author)
W86-03757

COMPARATIVE STUDY OF SEQUENTIAL REDOX PROCESSES IN THREE BRITISH AQUIFERS,
British Geological Survey, Wallingford (England).
W. M. Edmunds, D. L. Miles, and J. M. Cook.
IN: Hydrochemical Balances of Freshwater Sys-

tems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 55-70, 6 fig, 2 tab, 28 ref.

Descriptors: *Oxidation-reduction potential, *Oxygen depletion, *Oxygen transfer, *Groundwater, *Aquifers, *Aerobic conditions, *Anaerobic conditions, *Rocks, Oxygen, Nitrates, Denitrification, Methane, Hydrogen, Oxidation, Limestone, Sandstones, Sulfides, Sulfates.

The transition from aerobic to anaerobic conditions in water and rock has been followed in three major British aquifers - the Chalk, Lincolnshire Limestone and Sherwood Sandstone. Oxygen is maintained at levels of 6-10 mg/l in the aerobic aquifer sections but is removed abruptly at redox boundaries (redox potential +250 to +100 mV); in the sandstones, oxygen persists for many thousands of years. Nitrate is also stable in the presence of oxygen, but rapid denitrification occurs at the redox boundary. In the reducing section a zone (+100 to 0 mV) appears to be controlled by Fe(2+). Sulfide, together with Fe(2+), probably affects the redox potential below 0 mV although it is never a major component and SO4(2-) dissolution is quantitatively more important. Methane and hydrogen influence the redox potential below -200 mV. The sequences observed are in line with theoretical predictions and measured redox potential, even as a mixed potential, can be useful in monitoring redox changes in aquifers. (Author)
W86-03758

GROUNDWATER QUALITY EVOLUTION IN THE UPPER AQUIFER OF THE COASTAL DUNE AREA OF THE WESTERN NETHERLANDS,
Vrije Univ., Amsterdam (Netherlands). Inst. voor Aardwetenschappen.
P. J. Stuyfzand.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 87-98, 5 fig, 1 tab, 9 ref.

Descriptors: *Radioactive tracers, *Aquifers, *Groundwater dating, *Cation exchange, *Piezometers, *Minerals, *Halogens, Water quality, Sulfates, Nitrates, Metals, Heavy metals, Geohydrology, Aeration zone, Phosphates, Geochemistry.

The quality evolution of fresh groundwater younger than 30 yr is presented as observed in a piezometer nest equipped with miniscreens. Age was determined using H3, O18, and Cl. The aquifer is composed of sands on top of reducing, finer-grained deposits. Cl, SO4, NO3, F, Na, K, Mg and possibly Cu and Zn are almost exclusively derived from (high) atmospherical inputs. Adsorption of SO2, NOx and HF contributes also to this input. Atmospherically deposited Pb and V are almost completely retained in the unsaturated zone, Zn and Cd to a lower degree. Cu and F are partially immobilized within 2 m below the water table. Dissolution of shell fragments is important. Redox reactions involve O2, NO3, SO4, HCO3, Fe, Mn, PO4, NH4, U and possibly Zn and V. Biogenic opal is dissolved slowly in the fine-grained deposits. Cation exchange processes involve Na and Ca mainly, throughout the profile. Strong seasonal Cl-fluctuations are discernable to a depth of 3 m below the water table. Fluctuations in Na, K and Mg, which in bulk precipitation are strongly correlated with Cl, are dampened considerably due to cation exchange for Ca. (Author)
W86-03761

HYDROCHEMICAL PROCESSES IN GROUNDWATER DISCHARGE AREAS,
Uppsala Univ. (Sweden).
E. Eriksson.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 99-106, 5 fig, 4 ref.

Descriptors: *Geochemistry, *Geohydrology, *Surface-groundwater relations, *Evapotranspiration, *Carbon dioxide, *Groundwater, *Chemical properties, *Oxygen, Flow pattern, Groundwater movement, Chemical reactions, Calcite, Calcium, Calcium carbonate, Root zone, Minerals, Organic matter, Nutrients, Hardpan soils.

A groundwater discharge area is a site where groundwater enters the root zone from below. These sites are usually found along natural drainage channels. The flow pattern, and consequently, the mineralization of the discharging groundwater is, for the most part, a function of the geometry of the geometry of the drainage area. Processes due to changing partial pressures of oxygen gas in groundwater are the release of ferrous Fe into soils and the formation of Fe hardpans. Processes due to changing partial pressures of CO2 in groundwater are precipitation of CaCO3 and a decrease in the saturation with respect to calcite. A major factor influencing the chemical composition of discharged groundwater is evapotranspiration which increases the concentration of dissolved components, generally favors the accumulation of soil organic matter, and leads to the precipitation of calcite and formation of hardpans under sem-arid conditions. Under humid conditions, the accumulation of soil organic matter in groundwater discharge areas may lead to peat formation and soil rich in plant nutrients. In arid areas, evapotranspiration of discharged groundwater may lead to a sequence of salts precipitated along the flow pattern.
W86-03762

RESPIRATORY GAS CONTENT (O2 AND CO2) AND IONIC COMPOSITION OF RIVER WATER IN THE PLAIN OF ALSACE (EASTERN FRANCE),
Centre National de la Recherche Scientifique, Strasbourg (France). Lab. de Physiologie Respiratoire.
J-C. Massabuau, and B. Fritz.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 107-115, 4 fig, 2 tab, 9 ref.

Descriptors: *Aquifers, *Carbon dioxide, *Oxygen, *Dissolved oxygen, *Seasonal variation, *Diurnal distribution, *Ions, *Alluvial plains, Water table, Sodium chloride, Trout, Aeration, Groundwater, Alluvial rivers, Springs.

An important water table in the alluvial plain of the River Rhine interacts with all the surface waters. Measurements were taken of the annual and daily variations of respiratory gas content and ionic composition in rivers fed by this water table. Results showed that the hydrochemical balance which is steady at the springs varies as a function of distance from the emergences, with season of the year, the confluence with other water courses and with disturbance of the water table. The respiratory gas content is affected by the poorly aerated groundwater supply, and the equilibration with air, the climatic conditions and the effect of biota whose relative importance increases as a function of distance from the springs. The ionic composition, typical of water coming from a sandy, argillaceous aquifer under calcareous soil is influenced by NaCl waste from salt mines, which appears to have reacted in the aquifer by an exchange of Na(+) against Ca(++), followed by calcite deposition. Trout were also noted in the poorly aerated waters that were low in dissolved oxygen but were otherwise of good quality. The presence of the trout was attributed to an abundance of food in the form of freshwater shrimp.
W86-03763

CHANGES IN GROUND-WATER CHEMICAL COMPOSITION IN DRAINED PEAT BOGS IN CONNECTION WITH ENVIRONMENTAL PROTECTION MEASURES,
Akademiya Navuk BSSR, Minsk.
V. Pashkevitch.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 117-124, 1 fig, 7 ref.

Descriptors: *Chemical properties, *Groundwater, *Peat bogs, *Environmental protection, *Bogs, *Swamps, *Geohydrology, *Drainage, Groundwater mining, Oxidation-reduction potential, Iron, Organic matter, Oxidation, Trace elements, Chemical reactions, Geochemistry.

The main factors and processes governing groundwater chemical composition in swampy land are exemplified by a study of Byelorussian Polessie areas. Some trends in the change of the chemical composition of groundwaters under the influence of reclamation are described. It is shown that the oxidation-reduction conditions in groundwaters are changed during the post-reclamation period, which results in an alteration of migration conditions for elements with variable valency (Fe, Mn, S, etc.). The phenomenon of a rapid increase in Fe concentration in groundwaters during the first few years after reclamation is described. Soluble organic substances, Mn, P and some other microelements are intensively removed from the limits of the drained zone. This results in an impairment of surface-water quality. In the future, the reclamation by drainage will arrest peatforming processes and active generation of soluble organic substances in the areas concerned. Reclamation will promote oxidation conditions in groundwaters and decrease the concentration of a number of microelements. (Author)
W86-03764

HYDROCHEMISTRY OF SPRINGS FROM DOLOMITE REEFS IN THE SOUTHERN ALPS OF NORTHERN ITALY,
Vrije Univ., Amsterdam (Netherlands).
For primary bibliographic entry see Field 2K.
W86-03765

TEMPORAL CHANGES IN GROUND WATER QUALITY IN THE PHREATIC ZONE UTTAR PRADESH (INDIA) AND THEIR IMPACT ON SAMPLING SCHEDULE,
Central Chemical Lab., Lucknow (India).
B. K. Handa.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 167-177, 6 fig, 3 tab, 5 ref.

Descriptors: *Chemical properties, *Water analysis, Water quality, *Hydrologic data collections, *Statistical analysis, *Water sampling, *Temporal distribution, Dug wells, *Groundwater, Water sampling, Sampling, Data collections, On-site data collections, Statistical methods, Data interpretation, Variability.

Examination of the chemical data obtained by repeated analysis of dug well water samples from the phreatic zone in the Ganga alluvium of the Ballia district has shown that preparation of water quality maps based on single water sample analysis, collected year after year in any specific month is likely to lead to biased results. In order to devise a more reasonable sampling schedule, statistical methods were used on data obtained from the dug well water of Shahpur Bahmanauli. Random and more frequent sampling was recommended to assess the groundwater quality and determine the magnitude of changes in the concentrations of various water quality parameters. To achieve reliable data, a minimum of 2-4 samples/yr distributed randomly in time is suggested. Where resources present a severe constraint, reliable data may still be obtained by reducing the number of sampling points.
W86-03768

EVALUATION OF THE INTENSITY OF SOME RECENT EXOGENIC GEOLOGICAL PROCESSES IN THE U.S.S.R. BY THE HYDROGEOCHEMICAL BALANCES METHOD,
Akademiya Nauk SSSR, Moscow. Geologicheskii Inst.
For primary bibliographic entry see Field 2K.
W86-03777

HYDROCHEMICAL BUDGETING IN STUDIES OF GROUND-WATER RENEWABILITY IN AREAS OF GLACIAL FORMATION SYSTEMS,
Polish Academy of Sciences, Warsaw. Geological Sciences Inst.
J. Mitrega, and J. Pachla.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 331-341, 4 fig, 1 tab, 8 ref.

Descriptors: *Geohydrology, *Groundwater recharge, *Evapotranspiration, *Hydrologic models, *Infiltration, *Groundwater potential, *Water chemistry, *Surface-groundwater relations, *Tritium, Geochemistry, Models, Groundwater movement, Geophysics, Geomorphology.

Studies of the renewability of the potential groundwater supply of the Quaternary system show that the structure of the system may be viewed as a multicompartment model with rapid infiltration as a source of groundwater recharge and evapotranspiration as a considerable source of groundwater discharge. Hydrogeochemical studies are incorporated to support or reject models based on groundwater dynamics. The mechanism of groundwater recharge and the climatological/geomorphological effect determine the water balance of the basin as reflected in the composition of basic ions. The regional importance of Lake Hancza was downgraded, and its position within the surface/groundwater system suggests that some lakes may serve as natural gauging stations for regional analyses for recharge evaluation and corresponding environmentally smoothed tritium concentrations. Tritium identification of hydrogeological structures and base-flow balance suggests that the shallow groundwater system contributes almost exclusively to water circulation in the basins.
W86-03783

ACCUMULATION AND TRANSPORT OF WATER AND SOLUTES IN THE SATURATED AND UNSATURATED ZONES,
Institute for Soil Fertility, Groningen (Netherlands).
P. A. C. Raats.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 343-357, 7 fig, 1 tab, 1 append, 27 ref.

Descriptors: *Runoff, *Water quality, *Mathematical models, *Saturated zone, *Unsaturated zone, *Solute transport, *Water supply, *Surface-groundwater relations, Soil water, Mathematical studies, Temporal distribution, Subsoil drainage, Flow pattern.

Some aspects of the linear, time-invariant theory, causal systems (LS) of solute and water transport are reviewed and some of the simpler implications of nonlinearity and time-variance are described. The physical-mathematical model is based on equations which may be used to determine the pattern of streamlines and the velocity field for any geometry and boundary conditions. In general, for convective transport of solutes by steady flow of water in the saturated zone, the travel time density distribution can be evaluated on the basis of the flow pattern. In locations with homogeneous subsoils and deep water tables in the unsaturated zone, a surplus of precipitation and/or irrigation above evaporative demand will induce a vertical, purely gravitational flow of water. Examples of the model's application to studies of various aspects of water quantity and quality involving different transfer functions are given. The implifications of nonlinearity and the propagation of waves and fronts are discussed.
W86-03784

SALINE GROUNDWATER DISCHARGES FROM CRYSTALLINE ROCKS NEAR THUNDER BAY, ONTARIO, CANADA,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
S. K. Frape, P. Fritz, and A. J. Blackmer.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 369-379, 7 fig, 2 tab, 9 ref.

Descriptors: *Groundwater, *Salinity, *Geochemistry, *Geohydrology, *Saline water, *Salts, *Geophysics, Calcium, Chlorine, Sodium, Piezometers, Seismology.

Bedrock groundwater discharges have been identified in Northern Ontario in an area encompassing Lake Nipigon, Sibley Peninsula, and St. Ignace Island. Detailed studies including piezometric and seismographic tests and a geophysical survey and soil profile logging were carried out at a Lake Nipigon site where saline seeps discharge Na-Ca-Cl water containing at least 9000 mg/liter total dissolved solids from granitic rocks. The discharge points are overlain by glacio-lacustrine sediments. The discharges are <10 liters/day and mixing with local freshwater occurs within the unconsolidated sediments. The dispersion of the saline water in the deposits leads to the formation of moose licks which are characterized by the presence of soupy Na-rich clay sediments. Chemical and isotope analyses suggest a bedrock origin for the salt.
W86-03786

SURFACE AND GROUNDWATER MIXING AND IDENTIFICATION OF LOCAL RECHARGE-DISCHARGE ZONES FROM SEASONAL FLUCTUATIONS OF OXYGEN-18 IN GROUNDWATER IN FISSURED ROCK,
Uppsala Univ. (Sweden).
R. K. Saxena.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 419-428, 9 fig, 1 tab, 4 ref.

Descriptors: *Groundwater recharge, *Seasonal variation, *Oxygen isotopes, *Surface-groundwater relations, *Geologic fractures, *Fissure water, *Isotopic tracers, *Mixing, Groundwater movement, Surface water, Groundwater, Rocks, Radioactive tracers, Tracers, Boreholes.

Seasonal variations of Oxygen 18 (O18) in groundwater in relation to O18 variations in precipitation have been studied in a fissured hardrock area over a period of 2 yr. O18 content of groundwater has been determined at chosen depths in several boreholes penetrating to 100 m depth in the bedrock. It has been observed that the O18 content of the groundwater exhibited seasonal oscillations, i.e. low delta values just after the snowmelt and high delta values in November-December every year. The fluctuations in O18 were maximum at shallow depths but decreased with increasing depth, without any phase-lag. It seems that surface water inputs percolate quickly through the fissures and mix with the groundwater. From the isotopic depth profiles of the boreholes, it has been possible to identify local recharge and discharge zones. Electrical conductivity measurements of the groundwater also corroborate the results obtained by O18-tracing. Temperature profiles of the boreholes indicate that longitudinal convective mixing within the boreholes is negligible. The method for routine sampling of groundwater employing a water sampler has been verified by electrical and pressure pumping from isolated borehole-sections using packers. It is concluded that O18 is a useful environmental tracer of water for studying surface and groundwater interactions in fissured rocks. (Author)
W86-03790

2G. Water In Soils

AERATION/CIRCULATION FOR CONTROL OF ALGAL PRODUCTION,
Tetra Tech, Inc., Bellevue, WA.
R. A. Pastorok, T. C. Ginna, and M. W. Lorenzen.
IN: Proceedings of Workshop on Algal Management and Control, March 9-12, 1980, Pacific Grove, CA. Technical Report E-81-7, May 1981. Final Report. Army Engineer Waterways Experiment Station, Vicksburg, MS. p 57-97, 3 fig, 3 tab, 149 ref.

Descriptors: *Aeration, *Water circulation, *Lake restoration, *Algal control, *Water quality management, Oxidation, Destratification, Fish management, Nutrients, Eutrophication, Trophic level, Macroinvertebrates, Fisheries, Nuisance algae, Algae.

Artificial circulation or aeration is often used to manage problems caused by eutrophication in lakes. Air release devices must not be placed too far above the lake bottom or too close to the water surface. If the aeration device is undersized, it may provide insufficient oxygen. Both artificial circulation and hypolimnetic aeration can provide adequate aeration, although circulation does so more rapidly. Artificial circulation generally reduces the temperature of the surface water and lowers evaporation rates. The abundance of blue-green algae decreases as vertical profiles are disrupted. The increases of mixed depth and suspended silt will probably induce light limitation of peak algal biomass. Aeration/circulation may produce changes in benthic organisms without corresponding shifts in planktonic biomass and production. Aeration/circulation prevents winter and summer fish kills by alleviating anoxic conditions. It creates habitats for cold water fishes and enhances their food supply. Aside from raising the suspended silt levels, artificial circulation has no known adverse impacts on water quality. Macrophyte populations may increase if aeration improves water transparency. Aeration/circulation may raise N gas concentrations to levels capable of inducing gas bubble disease in fish. A surface pump and a bottom aerator should be used in very deep lakes. Long-term responses of lake systems to treatment should be examined. (Geiger-PTT)
W86-03487

ESTIMATING GROUNDWATER RECHARGE BASED ON INFILTRATION CHARACTERISTICS OF LAYERED SOIL,
National Sugar Research Station, Kisumu (Kenya).
For primary bibliographic entry see Field 2F.
W86-03566

COMPARISON OF SOIL MOISTURE CHARACTERISTICS PREDICTED BY THE ARYA-PARIS MODEL WITH LABORATORY-MEASURED DATA,
Lockheed Engineering and Management Services Co., Inc., Houston, TX.
L. M. Arya, J. C. Richter, and S. A. Davidson.
Available from the National Technical Information Service, Springfield, VA 22161 as N82-32792, Price codes: A17 in paper copy, A01 in microfiche. SM-L2-04247, JSC-17820, March 1982. 393 p, 2 fig, 4 tab, 2 ref, 2 append.

Descriptors: *Model studies, *Soil water, Soil horizons, *Computer models, *Computer programs, *Fortran, *Pore pressure, *Soil compaction, Models, Prediction, Comparison studies, Soil types, New Jersey, Particle size, Soil density, Soil porosity.

Soil moisture characteristics predicted by the Arya-Paris model were compared with the laboratory-measured data for 181 New Jersey soil horizons. The Arya-Paris model predicts moisture characteristics of a soil from its particle-size distribution and bulk density in the natural state of packing. The prediction is essentially a translation of the particle-size distribution curve into a moisture characteristic curve. For a number of soil horizons, the predicted and the measured moisture charactertistic curves are nearly coincident. For a large number of other soil horizons, the predicted and measured moisture characteristic curves are strikingly similar in shape. Since the model predicts both the soil water pressure and the soil water content, a computed data pair has uncertainties in both quantities. The measured data, however, consists of water content values for preset soil water pressures and thereby exhibits uncertainty in one dimension only. An example of the computational procedure of the Arya-Paris model and a Fortran program for processing large data sets are also included.
W86-03636

CARBON DIOXIDE IN THE SOIL ATMOSPHERE: SIMULATION MODEL PARAMETER ESTIMATION FROM FIELD MEASUREMENTS,
Amsterdam Univ. (Netherlands). Lab. for Physical Geography and Soil Science.
W. Bouten, F. M. de Vre, J. M. Verstraten, and J. J. H. Duysings.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 23-30, 2 fig, 3 tab, 22 ref.

Descriptors: *Model studies, *Carbon dioxide, *Mathematical models, *Temporal distribution, *Numerical analysis, *Respiration, *Soil environment, *Soil gases, Models, Cycling nutrients, Mathematical studies, Microorganisms, Soil water, Soil temperature, Computer models, Biochemistry, Root zone.

A one-dimensional numerical simulation model in FORTRAN was made to study the vertical distribution and temporal variation of partial CO2-pressure in the soil atmosphere. These pressures are a result of carbon dioxide production by microorganisms and plant roots on one hand and diffusion into the air on the other. The daily input data are soil water contents and CO2 production rates. The model was developed as a part of a research program on nutrient cycling in a forested glacial till (boulder clay) eco-system. Attention is focussed on the decalcification and acidification of boulder clay. In the present research, the model is used in its reversed form to determine CO2 production rates throughout the water unsaturated soil from fortnightly field measurements of soil partial CO2-pressures. The topsoil flux serves as a control. Tentative results of 6 months of measurement (June-December 1983) show distinct fluctuations during the growing season. However, to quantify the sensitivity of microbial and plant root production on soil temperature, moisture conditions and additional food supply, more measurements of CO2-pressures, soil respiration and microbial production are first needed. (Author)
W86-03755

2H. Lakes

CHEMICAL AND PHYSICAL PROPERTIES OF CONNECTICUT LAKES,
Connecticut Agricultural Experiment Station, New Haven.
C. R. Frink, and W. A. Norvell.
Bulletin 817, April 1984. 9 p, 8 fig, 3 tab, 42 ref, 4 append.

Descriptors: *Connecticut, *Lakes, *Eutrophic lakes, *Phosphorus, *Chlorophyll-a, *Algae, Lake classification, Lake morphology, Physical properties, Water properties, Water analysis, Density, Nutrients, Aquatic plants, Aquatic productivity, Limnology.

A total of 70 Connecticut lakes were studied during 1973-80, probing their sediments, sampling weeds and algae, and analyzing their waters for plant nutrients and other chemicals. This report summarizes these analyses and interprets the results in terms of nutrient status and the consequent growth of weeds and algae. Comparable chemical analyses of 35 lakes are available for 1937-39, making it possible to examine changes that may have accompanied changes in the environment. Total phosphorus (P), total nitrogen (N), chlorophyll-a and secchi depth criteria were used to assign lakes to six tropic categories. Lakes similar in nutrients, chlorophyll-a and transparency were clustered according to six characteristics: spring P, spring N, summer P, summer N, summer chlorophyll-a, and summer Secchi depth. The data show that phosphorus is the element controlling the growth of algae and that nitrogen is seldom limiting. Transparency is determined by algal growth and can be predicted by measurements of chlorophyll-a and color. A comparison with prior data shows an increase in total P and chlorophyll while transparency has decreased. Prediction of phosphorus concentrations using a model developed earlier for 35 lakes was similar to observed concentrations. Most of the lakes are fairly dilute bicarbonate waters, which has not changed much from the 1937-39 findings. These data should help develop strategies to control nutrient enrichment, and thus make the lakes more pleasant for all to use. (Atkins-Omniplan)
W86-03438

CURRENTS IN SAN PABLO BAY,
California Univ., Berkeley.
For primary bibliographic entry see Field 2L.
W86-03449

LARGE-SCALE OPERATIONS MANAGEMENT TEST OF USE OF THE WHITE AMUR FOR CONTROL OF PROBLEM AQUATIC PLANTS, REPORT 2: FIRST YEAR POSTSTOCKING RESULTS,
Florida Univ., Gainesville. School of Forest Resources and Conservation.
K. C. Ewel, and T. D. Fontaine.
Volume VII: A Model for Evaluation of the Response of the Lake Conway, Florida, Ecosystem to Introduction of the White Amur, Technical Report A-78-2, November 1981. Report 2 of a Series. Army Engineer Waterways Experiment Station, Vicksburg, MS. 157 p, 59 fig, 34 tab. 178 ref, 1 append. DACW39-76-C-0019.

Descriptors: *Nutrients, *Phosphorus, *Simulation analysis, *Hydrologic models, *Cycling nutrients, Phytoplankton, Models, Ecosystems, Food chains, Biomass, Eutrophication, Lakes, Succession, Computer models, Eutrophic lakes, Submersed plants.

Simulation of a model summarizing relationships between major biotic and abiotic components in Lake Conway, Florida, showed that the establishment of significant growths of submersed plants had enabled nutrients in sediments, previously removed from nutrient cycling, to be reintroduced into the water column where stimulation of phytoplankton production can occur. Nutrient loading from outside sources had declined over the last few years, and the simulations showed slowly declining submersed plant biomass and productivity as nutrients were washed out. The addition of white amur accelerated the decline of submersed plant biomass. As a result, the transfer of P into the water column also decreased, which in turn accelerated the reduction in phytoplankton biomass and productivity. Consumers that depended most heavily on the pelagic-grazing food chain decreased while consumers that depended most heavily on the benthic-detrital food chain showed little change. Ecosystem gross production and respiration declined at a fairly constant rate over a ten-yr period but net ecosystem production remained essentially the same as in baseline simulations. As a result, the percent of gross production that became net production increased and the ecosystem was set back to an earlier stage of succession. (Geiger-PTT)
W86-03454

LARGE-SCALE OPERATIONS MANAGEMENT TEST OF USE OF THE WHITE AMUR FOR CONTROL OF PROBLEM AQUATIC PLANTS, REPORT 1: BASELINE STUDIES, VOLUME V, THE HERPETOFAUNA OF LAKE CONWAY, FLORIDA,
University of South Florida, Tampa. Dept. of Biology.
J. S. Godley, R. W. McDiarmid, and G. T. Bancroft.
Volume V: The Hepetofauna of Lake Conway, Florida, Technical Report A-78-2, June 1981. Report 1 of a Series. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. 111 p, 42 fig, 5 tab, 10 ref, 1 append. DACW39-76-C-0047.

Descriptors: *Lakes, *Baseline studies, *Reptiles, *Amphibians, *Aquatic weed control, Biocontrol, White amur, Lake Conway, Florida, Aquatic habitats, Weed control, Snakes, Frogs, Alligators, Turtles, Salamanders.

This report summarizes the baseline conditions for the amphibian and reptile populations of Lake Conway, Florida, for the 15-month study period, June 1977-September 1978. These results will be used later to determine whether any changes in the herpetofauna result from the introduction of the white amur (Stenopharyngodon idella) into the lake system to control aquatic vegetation. This baseline report includes detailed descriptions of the herpetofaunal study sites and methods and community analyses of the temporal and spatial distributions and densities of the species by pool. A total of 5836 individuals representing 11 amphibian species and 16 reptilian species were observed or captured on Lake Conway during the baseline study period. Approximately 93% of the total species pool was obtained within the first 3000 specimens, and between 70% and 80% of the predicted herpetofauna inhabiting each pool has been recorded. Of the 27 species presently recorded from the Lake Conway complex, 11 occur in all pools and together account for 94.4% of the total sample. The mean relative densities of 11 species were found to vary significantly between pools. Development of the shoreline for housing during the baseline study period was shown to have a negative impact on some amphibian and reptile populations. (Author)
W86-03458

BOUNDARY CONDITIONS OF SEDIMENT SURFACES VIEWED FROM DO BEHAVIOR,
T. Yoshida, and T. Mimaki.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 8th U.S./Japan Experts Meeting, November 8-10, 1982, Tokyo, Japan. July 1984. p 112-129, 15 fig, 1 tab.

Descriptors: *Lakes, *Sediment-water interfaces, *Dissolved oxygen, *Stratification, Oxygen, Thermal stratification, Oxygen demand, Anaerobic conditions, Lake Nakanoumi, Japan.

The dissolved oxygen behavior in the sediment-water interface was investigated with column tests. Water samples from Lake Nakanoumi, Japan, and one of its inflowing rivers were used in the experiments. The sediment surface was always anoxic. Dissolved oxygen stratification was influenced by two factors: thermal stratification and oxygen demand of the sediment. The latter influence was noted within 10 cm of the sediment-water interface. Since no thermal stratification occurs in winter, the dissolved oxygen profile was constant throughout most of the water column until nearing the sediment, where dissolved oxygen levels rapidly decreased. In summer the dissolved oxygen stratification was exponential. (Cassar-PTT)
W86-03467

COMPARISON OF METHODS FOR ESTIMATING NUTRIENT RELEASE FROM LAKE SEDIMENTS,
For primary bibliographic entry see Field 5B.
W86-03477

PRELIMINARY GUIDE TO THE ONSITE IDENTIFICATION AND DELINEATION OF THE WETLANDS OF THE SOUTH ATLANTIC UNITED STATES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
R. T. Huffman, G. E. Tucker, J. W. Wooten, C. V. Klimas, and M. W. Freel.
Technical Report Y-78-7, May 1982. Final Report. 59 p, 6 fig, 4 ref, 1 append.

Descriptors: *Lakes, *Wetlands, *Aquatic plants, Marshes, Bogs, Fens, Salt marshes, Stream beds, Vegetation, Flooding, Saline water, Salt marshes.

Wetlands of the South Atlantic United States are mainly located on the coastal plain. Freshwater marshes are found in the plateaus. The types of wetlands and the prevalent vegetation are as follows: haline aquatic bed, algae and seagrass; freshwater aquatic bed, free-floating, floating-leaved, and submersed herbs; emergent haline coastal flats, halophytic and succulent forbs; emergent haline marshes, dense stands of graminoids with a few shrubs and forbs; freshwater flats, rooted, emersed herbs and sparsely scattered shrubs and trees;

freshwater marshes, dense stands of graminoids intermixed with occasional forbs; scrub-shrub wetlands and forested wetlands, medium to dense stands of shrubs and/or trees; stream beds, temporary stands of old witchgrass; and unconsolidated shores, temporary stands of goosefoot, barnyardgrass, summer cypress, and cocklebur. (Cassar-PTT)
W86-03480

PRELIMINARY GUIDE TO THE ONSITE IDENTIFICATION AND DELINEATION OF THE WETLANDS OF THE INTERIOR UNITED STATES.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
Technical Report Y-78-6, May 1982. Final Report. 49 p, 1 fig, 1 tab, 18 ref, 1 append.

Descriptors: *Lakes, *Wetlands, *Aquatic plants, Marshes, Bogs, Fens, Stream beds, Vegetation, Flooding, Mosses, Lichens, Saline water, Salt marshes.

Wetlands communities of the interior United States are classified into six widely varying ecoregions: warm continental, hot continental, subtropical, prairie, steppe, and desert. Most of the original, natural vegetation has been succeeded by agricultural crops. Wetlands have been characterized to help identify and delineate the wetlands. The freshwater aquatic bed wetlands community occurs in ponds, lakes, reservoirs, etc., and contains rooted, submerged plants; floating, nonrooted plants; and rooted plants with floating parts. The saline aquatic bed wetlands, uncommon in this area, are usually sparsely vegetated. Algae and rooted vascular plants occur in dense, scattered stands. Moss-lichen wetlands (often called bogs) occur in the northern midwest on acid, peaty soils. Sphagnum moss is the prevalent species. Emergent wetlands are dominated by erect, rooted, herbaceous hydrophytes, excluding moss and lichens. Perennials are dominant. Common emergent wetlands communities are saline inland flats (scattered halophytic herbs), saline marshes (saltgrass, spikesedge, bulrush, etc.), freshwater flats (rooted, emersed herbs and sparsely scattered shrubs and trees), and freshwater marshes (dense stands of graminoids intermixed with an occasional forb). Scrub-shrub wetlands and forested wetlands have woody vegetation less than 20 ft high. Vegetation is often stunted because of severe environmental conditions. Vegetated stream beds, commonly containing old witchgrass, are colonized during low flow and lose the vegetation during high flow. Unconsolidated shores are briefly vegetated by goosefoot, barnyard grass, summer cypress, and cocklebur, which are killed by rising water.
W86-03482

EXTRACELLULAR METABOLITE INVOLVEMENT IN PLANKTON COMMUNITY STRUCTURE,
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
K. I. Keating.
IN: Proceedings of Workshop on Algal Management and Control, March 9-12, 1980, Pacific Grove, CA. Technical Report E-81-7, May 1981. Final Report. Army Engineer Waterways Experiment Station, Vicksburg, MS. p 146-197, 158 ref.

Descriptors: *Diatoms, *Antibiotics, *Phytotoxicity, *Algal control, Vitamins, Predation, Algae, Cyanophyta, Algicides, Nuisance algae, Eutrophication, Silica, Aquatic populations, Biocontrol, Toxins, Toxicity, Phytoplankton, Biochemistry.

In the future, algal management is likely to employ chemical, engineering, and biological approaches to control lake eutrophication. The effects of extracellular metabolites are more far reaching in aquatic systems than in terrestrial systems. Studies of extracellular metabolites in aquatic plants and animals are reviewed. It is speculated that extracellular products contribute to the capacity of blue-green algae to limit predation by rejection, by inhibition feeding, or reproductive activities. Distinguishing between extracellular and membrane-bound metabolic products can help to determine the level, mode, and extent of antibiotic effects. Several studies demonstrate the antibacterial activity of algae and the toxicity of algae to vertebrates, including humans. Excretion, lysis, and decomposition play a part in releasing vitamins reqired by algae for reproduction. The addition of silica to lake waters to encourage diatom growth rather than blue-green algae growth is explored along with the possibility of timing of copper sulfate additions to prevent the release of diatom extracellular inhibitors from blue-green algae blooms. (Geiger-PTT)
W86-03491

CYANOPHAGES: ARE THEY POTENTIAL BIOLOGICAL CONTROL AGENTS OF NUISANCE BLUE-GREEN ALGAE,
California Univ., Riverside. Dept. of Plant Pathology.
P. R. Desjardins.
IN: Proceedings of Workshop on Algal Management and Control, March 9-12, 1980, Pacific Grove, CA. Technical Report E-81-7, May 1981. Final Report. Army Engineer Waterways Experiment Station, Vicksburg, MS. p 198-229, 5 fig, 68 ref.

Descriptors: *Algal control, *Cyanophyta, *Viruses, *Biocontrol, *Nuisance algae, Algae, Eutrophication, Phytotoxicity, Growth kinetics, Environmental effects, Adsorption, Separation techniques.

Methods that have been successfully used to isolate and purify a few of the well characterized cyanophages are described. The isolation of cyanophages from natural water samples requires enrichment or concentration followed by clarification and purification. The adsorption kinetics and growth curves of various cyanophages are essentially the same as those of bacteriophages. Growth of an algal host in the presence of the cyanophage results in the increased production of resistant strains. The effects of environmental factors and extracellular excretions on virus adsorption are not well known. Several field attempts to control blue-green algae with cyanophages have met with mixed results. In some cases, a broad spectrum of cyanophages must be available for controlling different types of algal species. An integrated approach to biological control might be tried to control nuisance algae under field conditions. (Geiger-PTT)
W86-03492

UTILIZATION OF BACTERIA IN MANAGING CYANOBACTERIAL POPULATIONS: A REVIEW AND UPDATE,
Medical Coll. of Ohio at Toledo. Dept. of Microbiology.
J. C. Burnham.
IN: Proceedings of Workshop on Algal Management and Control, March 9-12, 1980, Pacific Grove, CA. Technical Report E-81-7, May 1981. Final Report. Army Engineer Waterways Experiment Station, Vicksburg, MS. p 230-258, 8 fig, 3 tab, 46 ref.

Descriptors: *Cyanobacteria, *Aquatic bacteria, *Water quality management, Biocontrol, Microbiological studies, Lakes, Bacteria, Aquatic populations, Predation, Eutrophication, Reviews, Toxins, Ecological effects.

The bacterium Myxococcus xanthus offers excellent potential as a microbial control agent for cyanobacteria. This lytic system is capable of functioning in the total absence of heterotrophic nutrients other than aqueous cyanobacteria and can carry out cyanobacterial lysis at high agitation rates. The myxobacter AL-1 strain possesses both proteolytic and cell wall lytic activity. Scanning electron micrographs show a parallel orientation of nyxococcal cells on the surface of a spherule. It is postulated that myxococcal swarming is both the process responsible for the parallel orientation of bacteria at the spherule surface and the primary mechanism by which the myxococci concentrate the cyanobacteria in the spherule core. With the increasing costs of lake management the favorable cost/benefit ratio provided by biological control makes the development of microbiological control systems seem more attractive. A funding agency might utilize the multidisciplinary approach to review projects for lake or water management to decide which areas should receive research priority. The funding mechanism should include sufficient commitment to provide testing in controlled natural ecosystems. (Geiger-PTT)
W86-03493

EVALUATION OF COMMUNITY INFORMATION INDICES FOR MISSISSIPPI RIVER FISHERIES,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 7C.
W86-03499

DISTRIBUTION AND RELATIVE ABUNDANCE OF FISHES IN WISCONSIN; V: GRANT AND PLATTE, COON AND BAD AXE, AND LACROSSE RIVER BASINS,
Wisconsin Dept. of Natural Resources, Madison.
For primary bibliographic entry see Field 6G.
W86-03501

DISSOLVED ORGANIC MATTER AND LAKE METABOLISM: BIOGEOCHEMISTRY AND CONTROLS OF NUTRIENT FLUX DYNAMICS IN LAKES,
Michigan State Univ., Hickory Corners. W.K. Kellogg Biological Station.
R. G. Wetzel.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-021861. Price codes: A03 in paper copy, A01 in microfiche. DOE/EV/01599 -- 219 Pt 1, August 1982. Technical Progress Report. 48 p. EY-76-S-02-1599.

Descriptors: *Lakes, *Nutrients, *Organic matter, Water circulation, Lake stages, Limnology, Cycling nutrients, Biogeochemistry.

Progress on a long-term research program is reported. Allochthonous sources, cycling and influent output of particulate and dissolved organic matter and inorganic nutrients are outlined. Wetland-littoral metabolism, focussing on physiological ecology, population dynamics, decomposition controls, and the influences on organic-inorganic loading to lakes, is discussed. The importance of thermal stratification and mixing in the nutrient dynamics as well as phytoplankton succession and competition is emphasized. Temporary meromixis in the spring occurs in the lake about every three years. The entire sequence of nutrient regeneration, phytoplankton succession, productivity, algal mortality patterns, and effectiveness of inorganic-organic nutrient interactions from wetland-littoral sources are altered in those years. While the differences themselves are of major interest, mechanism differences of productivity control are emerging from these types of natural variations. These important regulatory mechanisms would not have been observed if the studies had been conducted over a period of less than three years. (Halterman-PTT)
W86-03504

AQUACULTURE IN DREDGED MATERIAL CONTAINMENT AREAS: PROCEEDINGS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
September 1982, Galveston TX, Miscellaneous Paper D-83-2, October 1983. 216 p.

Descriptors: *Ponds, *Aquaculture, *Dredging, *Aquatic habitats, *Fish farming, *Fish ponds, Design criteria, Toxicity, Fate of pollutants, Water quality, Habitats, Economic aspects.

A workshop examined issues affecting the technical, legal, economic, and practical use of dredged material containment areas (DMCAs) for aquaculture. The participants agreed that aquaculture as a secondary use of DMCAs would be profitable and desirable. Techniques for site development and pond management presently used are satisfactory in DMCAs; however, some differences exist in

land acquisition and permit procedures. Capital investment requirements could be significantly less due to simplified land acquisition, reduced land costs, and shared costs of dike construction and maintenance. Discussions in this workshop covered species suitable for aquaculture, water quality, health and disease control, pond design, effect of pollutants in the sediments, and property rights.
W86-03704

SITE DESCRIPTION OF DREDGED MATERIAL CONTAINMENT AREAS: AN OVERVIEW OF PHYSICAL, CHEMICAL, BIOLOGICAL FEATURES,
Army Engineer District, Galveston, TX.
R. Medina.
In: Aquaculture in Dredged Material Containment Areas: Proceedings, September 1982, Galveston, TX, Miscellaneous Paper D-83-2, October 1983. p 7-19, 20 fig.

Descriptors: *Ponds, *Aquaculture, *Aquatic habitats, *Dredging, *Fish farming, *Fish ponds, Sediments, Levees, Spillways, Aquatic life.

Dredged material containment areas (DMCA) differ physically, biologically, and chemically. Structural variability includes size, configuration, foundation conditions, water retention properties, and the presence of interior cells. Levees differ in height, width, continuity, and adaptability to aquaculture. Locations may be remote or have ready access to roads and commercial power sources. Water control structures vary in location, state of repair, and usefulness to the prospective culturist. Infrequently used DMCA may be heavily overgrown, while active DMCA, containing sand, silt, or clay, often have irregular bottom topography and potentially unstable interior soils. Most DMCA are biologically productive during inactive periods, but potential contaminants within or scheduled for disposal in DMCA should be assessed. The length of time an area is active and the frequency of disposal, important impacts in DMCA aquaculture activities, should be incorporated into all planning. Cooperation from the local Corps District is anticipated. (Author)
W86-03705

REVIEW OF SPECIES SUITABLE FOR CONTAINMENT SITE CULTURE (FRESH WATER),
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
R. R. Stickney.
In: Aquaculture in Dredged Material Containment Areas: Proceedings, September 1982, Galveston, TX, Miscellaneous Paper D-83-2, October 1983. p 79-90, 2 fig.

Descriptors: *Ponds, *Fish ponds, *Aquaculture, *Fish farming, *Aquatic habitats, Lakes, Habitats, Fish ponds, Catfish, Channel catfish, Invertebrates, Tilapia, Blue tilapia, Red drum, Drum, Crawfish, Shrimp, Striped bass, Bass, Largemouth bass, Sunfish, Minnows.

Fishes and invertebrates suitable for aquaculture in low salinity or fresh water dredging containment sites should be stenohaline or euryhaline types, fast growing, tolerant to extremes in water quality, have a history of successful aquaculture, and have high economic value. Fish species of the southern United States which appear to meet these criteria are the channel catfish (Ictalurus punctatus), blue tilapia (Tilapia aurea), and red drum (Sciaenops ocellatus). Suitable invertebrates are the crawfish (Orchonetes spp. and Procambarus spp.) and freshwater shrimp (Macrobrachium rosenbergii). Sport fish include striped bass (Morone saxatilis), largemouth bass (Micropterus salmoides), and sunfishes (Lepomis spp.). Bait species are minnows and goldfish.
W86-03706

POND MANAGEMENT: POLYCULTURE VS. MONOCULTURE,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
R. K. Strawn.
In: Aquaculture in Dredged Material Containment Areas: Proceedings, September 1982, Galveston, TX. Miscellaneous Paper D-83-2, October 1983. p 115-119, 13 ref.

Descriptors: *Ponds, *Aquaculture, *Dredging, *Fish farming, *Aquatic habitats, *Fish ponds, Lakes, Habitats, Shrimp, Blue shrimp, Green shrimp, Striped mullet, Mullet, Drum, Black drum, Redfish, Blue tilapia, Tilapia, Polyculture.

Polyculture, extensively used in Israel and the Far East, makes better use of resources than monoculture, thus increasing yield and returns. Some species combinations shown to be productive on the Gulf Coast are blue shrimp (Penaeus stylirostris) and green shrimp (P. vannamei), striped mullet (Mugil cephalus) and various shrimp (Penaeus spp.), and striped mullet (M. cephalus) cultured with black drum (Pogonias cromis). Redfish (Sciaenops ocellatus) and blue tilapia (Tilapia aurea) need to be evaluated both together and in polyculture with other species in dredged material disposal areas. (Author)
W86-03707

POND DESIGN AND MANAGEMENT FOR COASTAL AQUACULTURE,
Alabama Dept. of Conservation and Natural Resources, Gulf Shores. Claude Peteet Mariculture Center.
R. V. Minton.
In: Aquaculture in Dredged Material Containment Areas: Proceedings, September 1982, Galveston, TX. Miscellaneous Paper D-83-2, October 1983. p 135-142, 12 ref.

Descriptors: *Ponds, *Fish ponds, *Aquaculture, *Aquatic habitats, *Fish farming, *Dredging, Lakes, Aquatic life, Habitats, Bentonite, Predation, Fertilizers, Soil properties, Water quality, Temperature, Salinity, Oxygen, Dissolved oxygen, Zooplankton, Fish stocking.

Pond design and layout will ultimately determine the degree to which a pond can be managed. Preliminary survey of a prospective site should include soil analysis for water retention capabilities. Promising sites with permeable soils can sometimes be sealed to reduce water loss by mechanical means or through the addition of materials which form an impermeable blanket. The size of a pond is determined by many variables, including the topography of the land, available capital, construction expense, market demand of the product being cultured, and available labor. The pond bottom should slope toward the drain location with a minimum ratio of 1:1000. Harvest areas, or catch basins, are recommended for production ponds and should comprise approximately 10% of the pond area or be large enough to maintain the pond production during the harvest operation. Intake water should be filtered to prevent entry of predator or competitor species. Pond use, filling and drainage, and chemicals and fertilizers added to the pond should be kept as part of the permanent record for each pond. Minimum water quality parameters such as temperature, salinity, and oxygen should be monitored. Systematic pond preparation of each pond should be made prior to stocking of either larval or fingerling fish. Rotenone at a concentration of 4 mg per liter should be added to any water remaining in the harvest area to eliminate wild fish or fish from the previous culture period. Present information on fertilization in brackish water ponds is quite limited. Chicken manure has thus far given the best returns from fingerling production ponds at the Claude Peteet Mariculture Center. (Author)
W86-03710

SELECTION CRITERIA AND PROCEDURES FOR ESTABLISHING MARICULTURE FACILITIES IN EXISTING CONTAINMENT SITES,
Dow Chemical U.S.A., Freeport, TX. Texas Div.
For primary bibliographic entry see Field 5C.
W86-03712

DESIGN CRITERIA FOR AQUACULTURE PONDS ON DREDGED MATERIAL,
Soil Conservation Service, Washington, DC.
For primary bibliographic entry see Field 8I.
W86-03713

PHYTOPLANKTON-ENVIRONMENTAL INTERACTIONS IN RESERVOIRS: VOLUME 1.
Papers Presented at Workshop, April 10-12, 1979, Monterey, CA, Technical Report E-81-13, September 1981. Final Report. U.S. Army Environmental and Water Quality Operational Studies, Army Engineer Waterways Experiment Station, Vicksburg, MS. 379 p. Marc W. Lorenzen, Editor. DACW39-78-C-0088.

Descriptors: *Lakes, *Reservoirs, *Phytoplankton, *Algae, *Nutrients, Environmental effects, Model studies, Temperature, Water temperature, Kinetics, Light quality, Reservoir operation, Bioassays.

The state of the art in reservoir phytoplankton evaluations was the subject of a collection of papers presented at a workshop sponsored by the U.S. Army Engineer Waterways Experiment Station. Topics included phytoplankton-nutrient kinetics mechanisms in mathematical simulation models, effects of reservoir characteristics and environmental factors on modeling, use of detailed mechanistic models of phytoplankton dynamics, nitrogen fixation and phytoplankton interactions, DCMU-enhanced chlorophyll fluorescence as an indication of phytoplankton physiological status, taste and odor problems in reservoirs related to phytoplankton, bioassay approaches for assessing phytoplankton growth, relationship of dominant phytoplankton to water temperature and season, and relationship of dominant phytoplankton to nutrients.
W86-03716

PHYTOPLANKTON-NUTRIENT KINETICS MECHANISMS IN MATHEMATICAL SIMULATION MODELS, WITH SPECIAL ATTENTION TO RESERVOIRS AND IMPOUNDMENTS,
Environmental Research Lab.-Duluth, Grosse Ile, MI. Large Lakes Research Station.
V. J. Bierman.
In: Papers Presented at Workshop, April 10-12, 1979, Monterey, CA, Technical Report E-81-13, September 1981. p 11-32, 57 ref.

Descriptors: *Lakes, *Reservoirs, *Phytoplankton, *Nutrients, *Model studies, Mathematical models, Kinetics, Nitrogen, Phosphorus, Silicon, Monod equation, Eutrophication, Cell quota models, Growth rate, Algae, Internal pool models.

Formulations used to describe phytoplankton-nutrient kinetics in deterministic simulation models are reviewed. The rationale and assumptions of each formulation are discussed along with the data required to implement each formulation. Special attention is given to the nutrient recycle characteristics and to nutrient interactions in cases where there is more than one potential limiting nutrient. Fixed stoichiometry models (example, Monod equation) are simple to use because they are empirical equations which exclude processes occurring at the cellular level. Cell quota models (variable stoichiometry) assume that the stoichiometric composition of phytoplankton cells varies as a function of the balance between nutrient uptake rate and cell growth rate. They realistically describe the experimentally observed mode of cell growth without including complex biochemistry. Internal pool models (variable stoichiometry) can correctly describe the limiting behavior of nutrient uptake rates as a function of changes in internal nutrient levels. In choosing a model nutrient recycle kinetics must be considered. Each model type assumes a different mechanism. In models which include more than one potential limiting nutrient, a mechanism must be devised for calculating phytoplankton growth rates when the levels for both nutrients are nonoptimum. Two hypothesis are in use: the multiplicative hypothesis and the threshold hypothesis.
W86-03717

MODELING COMBINED EFFECTS OF ENVIRONMENTAL FACTORS ON PHYTOPLANKTON,
Rensselaer Polytechnic Inst., Troy, NY.
R. A. Park, and C. D. Collins.
In: Papers Presented at Workshop, April 10-12, 1979, Monterey, CA. Technical Report E-81-13, September 1981. p 148-195, 18 fig, 93 ref.

Descriptors: *Lakes, *Phytoplankton, *Model studies, *Reservoirs, *Nutrients, Mathematical models, Algae, Advection, Turbulent flow, Sedimentation, Temperature, Water circulation, Water temperature, Light, Predation, Mortality, Photosynthesis, Zooplankton, Cyanophyta, Respiration, Excretion, Water pollution effects.

This paper describes the characteristics of reservoirs that necessitate specific modeling approaches, reviews the combinations of process equations used in phytoplankton models, and gives examples of ways in which these equations are combined. Some reservoir characteristics and their effects on modeling are as follows: advection--loss of phytoplankton and flushing of nutrients; sinking of phytoplankton--variation with shape, specific gravity, size, surface chemistry of the algae, and viscosity and turbulence of surrounding water; temperature--variation of concentration of photosynthetic enzymes; nutrients--storage and delayed response to loadings; light--limited in some areas by turbidity, high density of phytoplankton, and turbulence; predatory mortality--difference in grazing patterns; nonpredatory mortality--effects unclear; respiration and excretion; and toxic chemicals. Eight models are explained and demonstrated. The Chen model and DiToro models are relatively simple. The Kremer and Nixon model is slightly more complex. More complex models are by Straskraba, Lehman-Botkin-Likens, Nyholm, Scavia, and Youngberg's CLEANER. Of these eight models, some present environmental responses as exponential, some use saturation kinetics, and some use nonlinear equations to account for optimal responses. Most combine some or all of the responses in a multiplicative fashion.
W86-03718

USE AND INTERPRETATION OF DETAILED, MECHANISTIC MODELS OF PHYTOPLANKTON DYNAMICS,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
D. Scavia.
In: Papers Presented at Workshop, April 10-12, 1979, Monterey, CA. Technical Report E-81-13, September 1981. p 196-222, 9 fig, 1 tab, 21 ref.

Descriptors: *Lakes, *Model studies, *Nutrients, *Phytoplankton, *Reservoirs, Mathematical models, Lake Ontario, Kinetics, Algae, Zooplankton, Grazing, Phosphorus, Nitrogen, Silicon, Oxygen, Carbonates, Stratification, Thermal stratification.

A model for phytoplankton dynamics was applied to lake-scale phytoplankton production and phosphorus cycling in Lake Ontario. The model includes phytoplankton, zooplankton, nutrient cycles, oxygen balance, and the carbonate equilibrium system. Each model compartment is represented by a differential equation composed of biological, chemical, and physical processes. Several conclusions were reached. In spring and fall phytoplankton dynamics are controlled by light. In late spring and summer phytoplankton production is limited primarily by silicon and phosphorus. During stratification, available phosphorus is supplied from several sources: 3% from external sources, 10% from the hypolimnion, and 87% from biological recycling. Zooplankton tend to reduce algal populations in midsummer but excrete nutrients usable by the phytoplankton.
W86-03719

NITROGEN FIXATION AND PHYTOPLANKTON INTERACTIONS IN SOUTHWESTERN RESERVOIRS,
Envirosphere Co., Bellevue, WA.
G. Lawley.
In: Papers Presented at Workshop, April 10-12, 1979, Monterey, CA. Technical Report E-81-13, September 1981. p 232-245, 3 fig, 4 tab, 6 ref.

Descriptors: *Lakes, *Nutrients, *Nitrogen fixation, *Phytoplankton, *Reservoirs, Lake Arlington, Lake Ray Hubbard, Texas, Eutrophication, Phosphorus, Nitrates, Sediments, Cyanophyta, Anabaena, Algae, Aufwuchs.

Nitrogen fixation potential was studied in two north Texas lakes. In Lake Arlington, used for powerplant cooling, nitrogen fixation in the water column varied from February through October, reaching a peak in early June. The passage of water through the powerplant cooling system apparently did not affect the ability to reduce nitrogen. Sediment fixation varied considerably but no temporal trends were evident. Nitrate levels varied inversely with nitrogen fixation, indicating that as nitrogen became scarce, the blue-green algae increased their nitrogen fixation rate. Total phosphorus levels varied in proportion with blue-green algal volumes. At some times in the year nitrogen fixation rates were high among epiphytic populations. Algal mats on the rocky shoreline reduced nitrogen at the yearly rate of 1 gram nitrogen per sq meter of rock surface. Likewise, the aufwuchs community and floating algal mats contributed considerable reduced nitrogen to the reservoir. In a nitrogen budget for Lake Arlington nitrogen fixation contributed 11%; rainfall, 11%; dry fallout 9%; watershed runoff, 42%; and point source discharges, 27%. In Lake Ray Hubbard high rates of nitrogen fixation were measured during a blue-green algal bloom.
W86-03720

DCMU-ENHANCED CHLOROPHYLL FLUORESCENCE AS AN INDICATION OF THE PHYSIOLOGICAL STATUS OF RESERVOIR PHYTOPLANKTON: AN INITIAL EVALUATION,
Oklahoma Univ., Kingston. Biological Station.
B. L. Kimmel, and M. M. White.
In: Papers Presented at Workshop, April 10-12, 1979, Monterey, CA. Technical Report E-81-13, September 1981. p 246-262, 4 fig, 1 tab, 28 ref.

Descriptors: *Lakes, *Phytoplankton, *Photosynthesis, *Fluorescence, *Chlorophyll, *Productivity, *Reservoirs, 3-(3,4-Dichlorophenyl)-1,1-dimethylurea, Inhibition, Lake Texoma, Broken Bow Lake, Texas.

Measurement of in vivo chlorophyll fluorescence response to DCMU (an inhibitor of photosynthesis) is applicable to field investigations of naturally occurring phytoplankton communities. Fluorescence response index (FRI) ranges of 0.11 to 0.68 were observed in southern Oklahoma reservoirs and ponds. The FRI profiles corresponded well to water column characteristics and to results of experiments that produced independent estimates of phytoplankton photosynthetic potential. Comparison of FRI data to photosynthetic carbon uptake in situ and in displacement experiments clearly shows DCMU-enhanced fluorescence response to reflect phytoplankton physiological state or photosynthetic potential rather than in situ primary productivity.
W86-03721

RELATIONSHIP OF COMMON DOMINANT PHYTOPLANKTON TO WATER TEMPERATURE AND SEASON,
Environmental Monitoring and Support Lab., Las Vegas, NV. Monitoring Operations Div.
W. D. Taylor, D. R. Hetzel, J. J. Janik, S. C. Hern, and L. R. Williams.
In: Papers Presented at Workshop, April 10-12, 1979, Monterey, CA. Technical Report E-81-13, September 1981. p 315-327, 6 fig, 3 tab, 3 ref.

Descriptors: *Lakes, *Reservoirs, *Phytoplankton, *Algae, *Temperature, *Seasonal variation, Temperature, Species composition, Myxophyceae, Diatoms, Melosira, Population dynamics.

The twenty most common phytoplankton genera were observed in 815 lakes and reservoirs throughout the U.S. to determine their relationship to water temperature and season. Melosira was by far the most common genus. The other genera, in order of decreasing number of dominant occurrences were Chroomonas, Cryptomonas, Oscillatoria, Stephanodiscus, Aphanizomenon, Fragilaria, Cyclotella, Dactylococcopsis, Lyngbya, Asterionella, Nitzschia, Microcystis, Synedra, Scenedesmus, Dinobryon, Anabaena, Merismopedia, Raphidiopsis, and Ankistrodesmus. Fifteen of the genera were either blue-green algae or diatoms. Diatoms dominated equally throughout the three seasons (spring, summer, fall). The blue-green algae were most important in summer and fall. Blue-green algae dominated in waters of higher temperature during each season. For diatoms, the temperature for domination occurrence was only slightly lower than the temperature observed for nonoccurrence, with the exception of Asterionella. It dominated in much colder waters, particularly in summer and fall. For the green algae, a difference of 6 degrees prevailed between the dominant occurrence and nonoccurrence values. Scenedesmus was dominant at higher temperatures; Ankistrodesmus, at lower temperatures. Temperature, per se, appeared to limit few of the genera studied, although particular temperature ranges seemed to allow more successful competition.
W86-03724

RELATIONSHIP OF COMMON PHYTOPLANKTON GENERA TO NUTRIENTS IN EASTERN AND SOUTHEASTERN LAKES,
Environmental Monitoring and Support Lab., Las Vegas, NV. Monitoring Operations Div.
V. W. Lambou, W. D. Taylor, L. R. Williams, and S. C. Hern.
In: Papers Presented at Workshop, April 10-12, 1979, Monterey, CA. Technical Report E-81-13, September 1981. p 328-363, 5 tab, 10 ref, 1 append.

Descriptors: *Lakes, *Nutrients, *Phytoplankton, *Algae, Nitrogen, Phosphorus, Species composition, Melosira, Scenedesmus, Nitrates, Nitrites, Ammonia, Water quality.

The relationship between the occurrence of the common phytoplankton genera and nutrient levels was studied in 250 lakes in the eastern and southeastern states. Melosira (appearing in 87%-92% of samples) was the most common of the 57 genera designated as common (appearing in at least 10% of the 692 samples). Other genera of importance (appearing in greater than 50% of samples), in descending order of occurrence were Scenedesmus, Synedra, Cyclotella, Oscillatoria, Euglena, Cryptomonas, Navicula, Nitzschia, Anabaena, and Microcystis. The following appeared in 40-50% of the samples: Pediastrum, Merismopedia, Tetraedron, Coelastrum, Dactylococcopsis, and Lyngbya. The frequency of occurrence was not related to community dominance. Most genera occurred over a wide range of nutrient conditions. A nutrient-rich group (less than 200 micrograms per liter total P) was identified: four chlorococcaleans, one green flagellate, and two filamentous blue-green genera. The nutrient-poor group (less than 70 micrograms per liter total P) included Asterionella, Dinobryon, Tabellaria, Peridinium, and Ceratium. The ranking schemes can be used to evaluate or predict water quality. For example, Scenedesmus dominance is associated with extremely high mean values for total P, ortho P, and Kjeldahl nitrogen. Dominance of blue-green algae were associated with low N/P ratios. The appendix is a computer-generated compilation of the data.
W86-03725

EFFECT OF LIGHT ATTENUATION ON THE RELATIONSHIP OF PHYTOPLANKTON BIOMASS TO PHOSPHORUS LEVELS,
Environmental Monitoring Systems Lab., Las Vegas, NV.
S. C. Hern, L. R. Williams, V. W. Lambou, and W. D. Taylor.
In: Papers Presented at Workshop, April 10-12, 1979, Monterey, CA. Technical Report E-81-13, September 1981. p 365-377, 3 fig, 3 tab, 14 ref.

Descriptors: *Lakes, *Reservoirs, *Phytoplankton, *Light quality, *Phosphorus, Solar radiation, Chlorophyll, Opacity, Secchi disks, Algae.

The effects of light attenuation on chlorophyll production were investigated in 800 lakes throughout the U.S. during 1972-1975. The response ratio (chlorophyllia/total phosphorus) was used to establish three groups: very low response (0.00 to less than 0.50), low response (0.50 to less than 1.0), and high response (greater than or equal to 1.0). At a response ratio of 1.0 or greater, all of the total phosphorus is theoretically associated with cellular chlorophyll a, meaning that algae are using all available phosphorus and incorporating it into cellular material. All but 1 of the 104 lakes in the low or high response groups had residual Secchi values less than 0.46 m. However, 42% of the 632 lakes with very low response had residual Secchi values of less than 0.46 m. This led to the conclusion that light, or a combination of light and other factors, was responsible for the inefficient utilization of total phosphorus in the low response group.
W86-03726

ROLE OF BOTTOM SEDIMENTS IN MODIFYING SOLUBLE PHOSPHATE LOADS TO A DENDRITIC, HYPERTROPHIC RESERVOIR,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 2J.
W86-03787

HYPOLIMNETIC OXYGEN DEFICIT IN A EUTROPHIC LAKE AND THE ROLE OF SEDIMENT OXYGEN DEMAND,
National Inst. for Environmental Studies, Tsukuba (Japan).
For primary bibliographic entry see Field 5C.
W86-03869

2J. Erosion and Sedimentation

SIMULATION OF ESTUARINE SILT TRANSPORT ACCORDING TO STORM WATER RUNOFF,
Y. Baba.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 8th U.S./ Japan Experts Meeting, November 8-10, 1982, Toyko, Japan. July 1984. p 185-201, 14 fig, 1 tab, 4 ref.

Descriptors: *Sediment transport, *Estuaries, *Model studies, Salinity, Tides, Neap tides, Spring tides, Ayase River, Japan, Storm runoff, Erosion, Suspended solids, Runoff.

Estuarine silt transport was simulated for the case of storm water runoff added to tidal flow motion. The Ayase River, Japan, was used to field observations. The following conclusions were drawn. (1) Suspended solids transport along the river reach was successfully simulated using a one-dimensional and one-layer model. Erosion velocity was based on experiments. (2) The simulation was satisfactory under the condition of a constant fall velocity of suspended solids value for both spring and neap tides. (3) For a non-negligible storm runoff rate longitudinal changes of the suspended solids fall velocity with the salinity level proved useful in obtaining a satisfactory simulation. (4) Relevant values of suspended solids fall velocity were not determined. (5) The model was not applicable to the situation in which a definite salt wedge was present. (Cassar-PTT)
W86-03465

SEDIMENT YIELDS OF AFRICAN RIVERS,
Exeter Univ. (England).
D. E. Walling.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No 144, 1984. p 265-283, 6 fig, 3 tab, 59 ref.

Descriptors: *Erosion, Literature review, *Sediment transport, *Suspended sediment, *Sediment yield, *Rivers, Africa, Bed load, Sedimentation, Organic matter, Sediment-carrying capacity.

Current knowledge on sediment transport by African rivers is reviewed. Uncertainties arise because of short data records, infrequent sampling, and great variability from one year to the next. Suspended sediment loads in African rivers draining basins on the order of 10,000 sq km are 1 to 4000 tons per sq km per year. The lowest mean annual sediment yield is 0.93 t per sq km, reported for the Chiari River in the Chad basin (193,000 sq km). The highest value is 19,520 t per sq km per year for the 1310 sq km Perkerra basin in Kenya, which has lost its vegetation cover through overgrazing. About 530 million t of sediment and 201 million t of dissolved load are transported to the ocean each year from Africa. A map shows the pattern of suspended sediment yield in Africa--lowest yields being in the northern desert; highest yields, along the northwest coast. Other sections of relatively high yields are the mountain and upland areas of East Africa and southern Africa. Factors controlling these spatial patterns include rainfall-runoff, geological factors, vegetative cover, and land use. In most rivers the suspended sediment load accounts for about 90% of the total load, bed load for about 10%. Studies on local erosion rates and downstream sediment yields are conflicting.
W86-03584

RATES OF EROSION AND SEDIMENT YIELD IN THE AFRICAN ENVIRONMENT,
University of East Anglia, Norwich (England).
M. Stocking.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No 144, 1984. p 285-293, 5 tab, 23 ref.

Descriptors: *Erosion, *Sediment yield, *Sediment transport, Africa, Denudation, Soil erosion, Tanzania, Land use, Grazing, Erosion control, Soil conservation, Conservation, Agriculture.

An overview of many sources, including field research, erosion plot data and studies of continental scale denudation and drainage basin sedimentation, shows that erosion rates in Africa are unexceptional overall, although there are significant localized areas with erosion greater than 100 t per ha per year. Vegetation cover is acknowledged to be principal determinant of specific erosion rates, and its lack controls the incidence of very high erosion. A case study in the Shinyanga region of Tanzania using low-level aerial survey and simple field techniques demonstrates the localized nature of erosion and sediment yield in Africa. Measured rates of erosion are almost wholly explained by the variable condition of rangeland, and the different types of farming and crops on flat-cultivated and ridged fields. It is argued that the only long-term way of controlling erosion rates in the African environment is through vegetative protection and fertility-enhancing farming systems, rather than mechanical protection. (Author)
W86-03585

APPRAISAL OF SEDIMENT TRANSPORT MEASUREMENT IN GHANAIAN RIVERS,
Water Resources Research Inst., Accra (Ghana).
For primary bibliographic entry see Field 7A.
W86-03586

SUSPENDED SEDIMENT TRANSPORT MEASUREMENT IN LESOTHO,
Department of Hydrology and Meteorology, Maseru (Lesotho).
S. Makhoalibe.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No 144, 1984. p 313-321, 5 fig, 2 tab, 6 ref.

Descriptors: *Erosion, *Sediment transport, *Suspended sediments, Lesotho, Senqu River, Caledon River, South Africa, Rivers, Orange River.

This paper discusse the suspended sediment data collected in Lesotho during the period 1976-1982. The drainage areas of the measuring sites vary between 200 and 20,000 sq km. The results demonstrate that annual suspended sediment yields range from less than 10 t per sq km in the igneous region to more than 2000 t per sq km in the sedimentary region. Sediment production rates in the basaltic region are mainly controlled by the extent of the cultivated area. Calculations for the cultivated areas in two drainage areas in this region gave the same estimate of sediment yield of 1 t per sq km per year from an area of 10 sq km. A comparison of Lesotho data with those from the Orange River and its tributaries in the Republic of South Africa reveals that the Caledon basin exhibits the highest sediment yields followed by the Vaal and the Senqu (Upper Orange) basins. (Author)
W86-03587

GULLY EROSION IN THE AGULU-NANKA REGION OF ANAMBRA STATE, NIGERIA,
Anambra State Univ. of Technology, Awka (Nigeria). Dept. of Earth Sciences.
B. C. E. Egboka, and E. I. Okpoko.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 335-347, 6 fig, 11 ref.

Descriptors: *Erosion, *Erosion control, *Groundwater, *Gully erosion, *Geohydrology, *Aquifers, Tropical regions, Geochemistry, Hydrology, Environmental effects, Nigeria.

In the Agulu-Nanka area gully erosion covers an area of about 1100 sq km. The gullying started around 1850, and the rate of gully growth is estimated at about 20-50 m per year. The British Colonial Office and the local inhabitants attempted to control the gullying by constructing dams and planting small trees, but the measures failed. The area lies in the humid tropical rain forest belt of Nigeria. The landscape is a cuesta within the Awka-Orlu uplands formed by the Nanka formation (early Eocene) and the Imo Shale formation (Palaeocene). Both the geological, hydrogeological, geotechnical and hydrogeochemical characteristics of the area and human activity have contributed to gully development and growth. Major aquifers and aquitards form multiaquifer systems, and heavy rainfall causes a rise in the water table. The increase in hydraulic head produces rapid flow rates that enhance the gullying process. Expansion and contraction of the clays and shales in the rainy and dry seasons, respectively, lead to slumping and landslides. Slightly acidic waters produced by redox reactions decompose cementing materials, thereby disaggregating the sand grains and facilitating gullying. An integrated approach is suggested for controlling erosion and gullying. It includes detailed mapping of the affected areas and other areas of potential gullying, and evaluating the adverse effects of rainfall, groundwater flows and seepage, water geochemistry, and anthropogenic activites such as agriculture. (Author)
W86-03589

MEASUREMENT OF SOIL LOSS FROM EXPERIMENTAL BASINS IN MALAWI,
Hydraulics Research Station, Wallingford (England).
M. B. Amphlett.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 351-362, 5 fig, 1 tab, 12 ref.

Descriptors: *Erosion control, *Soil erosion, *Soil conservation, *Land use, *Nutrients, Malawi, Sampling, Vegetation, Rainfall, Runoff, Conservation, Agricultural hydrology.

Field measurements (rainfall, runoff, soil moisture, crop cover, and soil and nutrient losses) were made in four basins under different land use and management practices: complete physical conservation and a land use plan, intensive uncontrolled arable farming without any physical conservation or land use plan, complete physical conservation with no land use plan, and eucalyptus plantation. Results

clearly demonstrate the effects of the different land use practices. Soil losses (in t per ha) during the rainy season were as follows: fully managed basin, 0.15 and 0.2; eucalyptus plantation, 0.13; traditionally farmed basin, 16.0; and the partially managed basin, 2.5. Losses of soil and nutrients from the four basins were consistent with runoff totals. Equipment and techniques developed for this project are described: a pump sampler with programmable chip and a crop cover meter.
W86-03590

SOME METHODS FOR EVALUATING SOIL EROSION RISK,
A. Giordano.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 385-395, 2 fig, 28 ref.

Descriptors: *Erosion, *Soil erosion, *Land use, *Maps, Morocco, Vegetation, Soil types, Satellite technology.

Soil erosion was studied at the site level, drainage basin level and regional level using two methods. A portable rainfall simulator was tested in southern Italy on silty soil with low organic content. At a 47 min rainfall with an intensity of 71 mm per hour, a soil loss of 7.9 t per ha was produced. This compared with 10.5 t per ha calculated from the USLE equation. An empirical model including the factors of rainfall erosivity, soil erodibility, slope, slope length, vegetation cover, and cultural practices, was applied to the Oued Setah basin, Morocco. The resulting grid square maps (scale 1:20,000-1:100,000) showed that erosion risk was highest in the mountain summit areas and on the glacis with poor drainage networks, sandy soil texture and a high fire risk. The same method is useful on the regional level. Here satellite imagery can be useful in producing maps at sales of 1:100,000-1:500,000.
W86-03593

PREDICTING THE SEDIMENT CAPACITY OF A CHANNEL,
G. M. Smart.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 397-401, 3 ref.

Descriptors: *Sediment transport, *Hydraulic properties, *Channels, *Slopes, *Water resources development, Alluvial channels, Mathematical studies, Tanzania.

Alluvial sediment causes major problems in the development of African surface water resources. Almost all formulae for predicting sediment transport capacity are only applicable to low values of channel slope. Experiments and computer analyses have been used to derive a new equation suitable for alluvial sediments with mean grain diameter >0.4 mm on slopes up to 20%. The new equation closely predicts the sediment transport measured at Stiegler's Gorge in Tanzania. (Author)
W86-03594

SEDIMENT YIELD ESTIMATION AND THE DESIGN OF SEDIMENT CONTROL STRUCTURES IN RURAL AFRICA,
Steffen, Robertson and Kirsten, Inc., Johannesburg (South Africa).
For primary bibliographic entry see Field 4D.
W86-03595

SHEET EROSION FROM ARABLE LANDS IN ZIMBABWE: PREDICTION AND CONTROL,
Institute of Agricultural Engineering, Harare (Zimbabwe).
H. A. Elwell.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 429-438, 5 fig, 1 tab, 14 ref.

Descriptors: *Erosion, *Soil loss, *Model studies, Zimbabwe, Sheet erosion, Rill erosion, Gully erosion, Cropland, SLEMSA model, *Erosion control.

Rill and gully erosion on arable lands in Zimbabwe have been effectively controlled by mechanical conservation measures (contour ridges, storm drains, and waterways). However, rates of soil loss by sheet erosion of between 50 and 80 t per ha per year have been estimated. Forward projections indicate that this rate of soil loss will destroy the productive potential of large tracts of cropland within the next 30-50 years. The locally developed soil loss estimator SLEMSA and a soil life-span model are described, and their role in devising acceptable conservation strategies is discussed. (Author)
W86-03596

APPROACH TO TESTING THE USLE FACTOR VALUES IN KENYA,
Agricultural Research Service, Morris, MN.
C. A. Onstad, A. M. Kilewe, and L. G. Ulsaker.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 439-450, 1 fig, 6 tab, 23 ref.

Descriptors: *Erosion, *Soil loss, *Universal Soil Loss Equation, Maize, Kenya, Erosivity, Agricultural engineering, Soil erosion, Storms, Runoff.

The applicability of the Universal Soil Loss Equation to the Kenya region was studied in a set of 12 field runoff plots established on an alfisol. The supporting practices factor (average of 0.66 for contouring) was directly transferable. Erosivity, expressed by the product of the storm total kinetic energy and the maximum 30-min intensity, was satisfactory for predicting soil loss. Preliminary crop management factors for maize and for maize with 3 t per ha residue were determined. These values were within the ranges quoted by sources throughout the world. The erodibility factor for soil at the site was 0.24 (English units) or 0.0314 t ha h per ha per MJ per mm.
W86-03597

EVALUATION OF FACTORS INFLUENCING WATER EROSION IN WEST AFRICA USING RAINFALL SIMULATION,
Office de la Recherche Scientifique et Technique Outre-Mer, Abidjan (Ivory Coast).
J. Collinet, and C. Valentin.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 451-461, 3 fig, 6 tab, 16 ref.

Descriptors: *Erosion, *Soil loss, *Soil conservation, Storms, *Agriculture, *Rainfall simulators, Erosion control, Africa, Rainfall intensity, Precipitation, Antecedent moisture, Soil moisture, Universal Soil Loss Equation, Farming, Rainstorms, Vegetation, Mulching, Conservation.

In order to provide an improved understanding of the factors influencing water erosion in western Africa, field studies were carried out in three countries (Ivory Coast, Upper Volta, and Niger). Two types of rainfall simulators were used. Particular attention was given to the intensity-duration curves, the kinetic energy of the storms, and to the range of antecedent soil moisture conditions. Treatments were selected in accordance with the farming systems prevailing in the study areas. Results were consistent with those obtained under natural rainfall. They suggested that surface gravel and cobbles are very effective in reducing erosion. In the humid tropics, the erosive effects of storm rainfall are offset by the natural protection provided by the vegetative cover. The effectiveness of traditional conservative practices depends upon the soil water infiltration. Above certain threshold values, ridges collapse and as a result erosion is strongly enhanced. Likewise, the efficiency of residue mulch depends upon the texture of the topsoil. Consequently, the indiscriminate use of the Universal Soil Loss Equation which includes factors which are assumed to be independent can be highly hazardous. (Author)
W86-03598

TESTING THE APPLICABILITY OF A SOIL ERODIBILITY NOMOGRAM FOR SOME TROPICAL SOILS,
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
A. Vanelslande, P. Rousseau, R. Lal, D. Gabriels, and B. S. Ghuman.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 463-473, 4 fig, 7 tab, 9 ref.

Descriptors: *Erosion, *Soil erosion, Soil types, Nigeria, Tropical regions, Runoff, Soil structure, Sand, Clays, Nomograms.

Soil erodibiity measurements using field runoff plots were made for three contrasting soils in Nigeria. The soils were sand-silt-clay mixtures, one high in clay content, two high in sand content. Rainfall intensity was monitored for each experimental site using a daily recording rain gage. Soil erodibility, determined from field measurements were 0.015, 0.04, and 0.04 (in SI units) for the clay soil and the two sandy soils, respectively. Soil erodibility estimated from a nomogram were 0.039, 0.025, and 0.18 for the same three soils, respectively. The considerable differences between estimated and field results show that the nomogram should be modified to be used for tropical soils.
W86-03599

IMPACT OF SEDIMENT ON RESERVOIR LIFE,
Binnie and Partners, London (England).
J. D. Pitt, and G. Thompson.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No 144, 1984. p 541-548, 4 fig, 4 ref.

Descriptors: *Sedimentation, *Reservoir silting, *Sediment discharge, *Silting, Model studies, Mathematical models, Tarbela Reservoir, Oued Isser Reservoir, Algeria, Sediment transport.

Sedimentation in reservoirs can be studied with mathematical and physical models. Reservoir half life as a function of the average sediment concentration of the inflow, reservoir volume, and mean annual inflow are shown in a set of curves. Reservoirs fall into three classes: those with storage in excess of 50% of mean annual inflow, having half lives in hundreds of years; 5-50% of mean annual inflow, having half lives in decades; and smaller reservoirs, having half lives <20 years. For the largest reservoirs, sediment studies should consider possible land use changes and the effect of internal sediment flows. For the mid-size reservoirs, sediment sluicing is useful. For the smallest reservoirs, it is essential to maintain reservoir capacity. A modification of the Corps of Engineers program HEC6 is used to model the distribution of sediment deposits and a typical cross section in the Tarbela Reservoir.
W86-03604

PREDICTING THE DISTRIBUTION OF DEPOSTIED SEDIMENT IN SOUTHERN AFRICAN RESERVOIRS,
Rand Afrikaans Univ., Johannesburg (South Africa). Dept. of Civil Engineering.
G. W. Annandale.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 549-558, 6 fig, 4 tab, 24 ref.

Descriptors: *Sedimentation, *Reservoir silting, *Silting, Model studies, South Africa, Borland-Miller model, Reservoir storage, Storage.

The Borland-Miller (1958) method for predicting distribution of deposited sediment in reservoirs was evaluated using data from several South African reservoirs. The method was unreliable and did not provide sufficient information to assess the influence of sediment deposition on flood lines. A semi-empirical method based on the principle of minimum stream power was proposed. It allowed dis-

tribution of sediment as a function of distance from the dam wall for various rates of change in reservoir width with distance. The general behavior of the dimensionless cumulative curves was verified qualitatively. The semi-empirical method was recommended for preliminary design of reservoirs where relatively large quantities of deposited sediment are expected.
W86-03605

SEDIMENT DEPOSITION IN MAJOR RESERVOIRS IN THE ZAMBEZI BASIN,
Hydraulics Research Station, Wallingford (England).
P. Bolton.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No 144, 1984. p 559-567, 2 fig, 8 ref.

Descriptors: *Sedimentation, *Reservoir silting, *Silting, Lake Kariba, Lake Cabora Bassa, Zambezi Basin, Reservoir storage, Storage, Erosion.

The rates of sediment deposition were estimated for Lake Kariba and Lake Cabora Bassa in the Zambezi basin, Zimbabwe. Lake Kariba, with a mean annual sediment input in the range of 7 to 70 million tons, is expected to fill with sediment in 1,600 to 16,000 years. The dead storage capacity of Kariba, 116 billion cu m, is 60% of total capacity. Since the reservoir has a longitudinal profile and a relatively small drawdown (9 m maximum), all incoming sediment is likely to reach dead storage. Lake Cabora Bassa, with a sediment input about 3 times that of Lake Kariba and a dead storage of 12.5 billion cu m at a level of 295 m, will probably fill within 60-600 years. However, it is feasible to establish a minimum level of 305 m, which would increase the reservoir life to 350-3500 years. Much of the sediment accumulation in Cabora Bassa is likely to occur in the live storage area. As silt accumulates, it will be necessary to increase the annual drawdown to provide the current degree of downstream flood protection. Thus, sedimentation will affect Lake Cabora Bassa within its economic life.
W86-03606

SEDIMENT STORAGE REQUIREMENTS FOR RESERVOIRS,
Ministry of Water Resources and Development, Harare (Zimbabwe).
T. C. Kabell.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No 144, 1984. p 569-576, 2 fig, 2 tab.

Descriptors: *Sedimentation, *Sediment control, *Reservoir silting, *Silting, Reservoir storage, Storage, Zimbabwe, Water storage.

Reservoir sedimentation is a serious problem in Zimbabwe, leading to diminished draft or even total loss of live storage capacity. The correct solution undoubtedly lies in improved conservation and land use practices, but unless and until such measures are adopted, adequate allowace for sedimentation must be included in water storage works. Sediment loads are known to vary widely between different rivers and from season to season, but there is a lack of sediment load data for Zimbabwe. It is proposed that until more reliable figures of sedimentation rates are available, reservoirs should be designed to include a provision for sedimentation based on the mean annual runoff from the drainage basin. The sediment storage requirements have been estimated from surveyed volumes of silt deposited in a number of reservoirs over a period of several years. (Author)
W86-03607

FEASIBILITY OF FLUSHING SEDIMENTS THROUGH RESERVOIRS,
Hydraulics Research Station, Wallingford (England).
W. R. White, and R. Bettess.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No 144, 1984. p 577-587, 7 fig, 2 tab, 4 ref.

Descriptors: *Sediment control, *Reservoir silting, *Silting, *Flushing, *Sedimentation, Model studies, Reservoir storage, Storage, Kamativi Dam, Gwai River, Zimbabwe.

The effect of sediment flushing of reservoirs was studied using a computational model, which was applied to the proposed Kamativi Dam on the Gwai River, Zimbabwe. The Gwai drainage basin has an area of 38,600 sq km and a mean annual runoff of 580 million cu m. Results showed that, without sediment flushing, the reservoir's useful life would be about 30 years. Sediment flushing would extend the reservoir life significantly. Using large-capacity low level outlets could establish a state of dynamic equilibrium so that adequate water supplies could be provided for an indefinite period. For flushing to be effective, water levels must be maintained at low levels during a period of high river flow. Thus, sediment flushing is not appropriate where a reservoir is used for over-year storage, where the required water yield of the reservoir is comparable with the annual river flow or where periodic interruptions to the use of the reservoir cannot be tolerated.
W86-03608

USER'S MANUAL FOR THE INSTREAM SEDIMENT-CONTAMINANT TRANSPORT MODEL SERATRA,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5B.
W86-03630

MATHEMATICAL MODEL, SERATRA, FOR SEDIMENT-CONTAMINANT TRANSPORT IN RIVERS AND ITS APPLICATION TO PESTICIDE TRANSPORT IN FOUR MILE AND WOLF CREEKS IN IOWA,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5B.
W86-03648

SEDIMENTS OF THE UPPER MISSISSIPPI RIVER: THEIR SOURCES, DISTRIBUTION, AND CHARACTERISTICS,
Winona State Univ., MN.
D. N. Nielsen, R. G. Rada, and M. M. Smart.
In: Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium, Butterworth, Boston. 1984. p 67-98, 20 fig, 18 ref.

Descriptors: *Environmental effects, *Sediment transport, *Erosion, Rivers, Mississippi River, Geology, Hydrology, Land use, Glacial sediments, Tributaries, Sediment yield, Chippewa River, Wapsipinicon River, Suspended sediment, Particle size, Bed load, River beds, Channel morphology, Navigation, Locks, Dams.

The geology, hydrology, and land use of the Upper Mississippi River Basin are described and related to the kind and amount of sediment delivered to the river. Sources of sediment are in tributary basins. Non-bedrock sources (eroded soil, loess, glacial drift, colluvium, and alluvium) are quantitively greater than bedrock sources. Tributaries with bed-load discharges equal to or greater than suspended-load discharges cause sediment transport problems and affect channel morphology in the Mississippi. Tributaries with more cohesive, finer sediments have little effect on channel morphology. However, they contribute greater volumes of fine sediment which is deposited in backwater areas. Total sediment yield increases from the northern to southern end of the basin because of increased runoff, agricultural activity, and differences in surface materials. The average particle size of suspended sediments is relatively uniform at equivalent flows and in tributaries of similar geology, land use, etc. Valleys containing glacial outwash produce suspended sediment of larger average particle size. The islands in the river are a result of overloading of the channel with coarse bed load and channel avulsion during high flows. Navigation dams have produced pools which are collecting fine sediment. Tail water areas have degraded because of sediment trapping in the pool and excess energy in the discharges.
W86-03740

RECENT RATES OF SEDIMENTATION IN THE MISSISSIPPI RIVER,
Agricultural Research Service, Durant, OK. Water Quality and Watershed Research Lab.
J. R. McHenry, J. C. Ritchie, C. M. Cooper, and J. Verdon.
In: Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium, Butterworth, Boston. 1984. p 99-117, 3 fig, 7 tab, 9 ref.

Descriptors: *Sedimentation rates, *Environmental effects, *Lakes, Rivers, *Aquatic habitats, Habitats, Mississippi River, Lake Pepin, Marshes, Backwater.

Mean sedimentation rates in several backwater lakes and pools in the Upper Mississippi River Valley were 3.4 cm/year during 1954-64 and 1.8 cm/year in 1965-75. In spite of the decrease in sedimentation, many of these lakes are expected to become marshes on the order of 50-100 years. Before the backwater lakes were formed by the construction of locks and dams, sediment deposition on the floodplains was largely unnoticed. Within the last few years the noticeable sedimentation has caused public concern. Maximum soil conservation measures are necessary to preserve the riverine habitat as long as possible.
W86-03741

INTERACTION WATER-SILICATE MINERALS IN THE UNSATURATED ZONE CONTROLLED BY THERMODYNAMIC DISEQUILIBRIA,
Kiel Univ. (Germany, F.R.).
For primary bibliographic entry see Field 2K.
W86-03756

ROLE OF BOTTOM SEDIMENTS IN MODIFYING SOLUBLE PHOSPHATE LOADS TO A DENDRITIC, HYPERTROPHIC RESERVOIR,
National Inst. for Water Research, Pretoria (South Africa).
A. J. Twinch.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 381-392, 4 fig, 1 tab, 16 ref.

Descriptors: *Phosphates, *Phosphorus, *Bottom sediments, *Adsorption, *Simulation analysis, *Reservoirs, *Computer models, *Lake sediments, Sediment transport, Models, Model studies, Rivers, Hydrologic models, Phosphorus removal, Dissolved solids, Fluvial sediments.

A survey of phosphate uptake/release characteristics of sediments in a riverine section of a dendritic impoundment was undertaken to assess their role in modifying soluble phosphate concentrations in the inflowing river water. A sharp gradient in soluble phosphate concentration occurs along a 5 km riverine stretch between the river inflow (>1mg/liter) and the main body of the reservoir (about 0.5 mg/liter). The results of this study suggest that direct phosphate uptake by bottom sediments may be partly responsible for this phenomenon. A simulation model was developed to quantify this phosphate uptake at varying river flow rates and reservoir water levels. The simulation runs suggest that up to 50% of the total soluble phosphate load could be retained by sediments in the riverine section. However, this is insufficient to account for the observed gradient and other factors must also be important in controlling the decline in phosphate concentration. (Author)
W86-03787

CALIBRATION OF HYDROLOGY AND SEDIMENT TRANSPORT ON SMALL AGRICULTURAL WATERSHEDS USING HSPF,
Camp, Dresser and McKee, Inc., Boston, MA.

D. E. Schafer, D. A. Woodruff, R. J. Hughto, and G. K. Young.
In: Proceedings of Stormwater and Water Quality Management Modeling Users Group Meeting, March 25-26, 1982, Washington, DC. EPA-600/9-82-015, August 1982. p 54-68, 6 fig, 2 tab, 11 ref.

Descriptors: *Mathematical models, *Agricultural watersheds, *Calibrations, Sediment transport, Agricultural runoff, Hydrologic models.

This paper discusses the capabilities of the Environmental Protection Agency's Hydrology Simulation Program-FORTRAN (HSPF) for modeling runoff and sediment transport on three small agricultural watersheds: Mississippi 802, Oklahoma C-4, and Oklahoma C-5. HSPF appears to be suitable for simulating runoff and sediment from agricultural watersheds. However, the model should be verified on each of these watersheds before being used as a predictive tool. An independent data set for verification would provide a test for the calibrated parameter values, and further analyze the model's applicability to these particular watersheds and to agricultural watersheds in general. The ability of the model to simulate the hydrologic response and sediment removal from the watersheds is considered reasonably good. Large percent differences between measured values were extremely high. This is particularly evident during the initial months of simulation in which initial conditions may be partially responsible for poor simulation. Overall good model performance is best illustrated by the double mass analysis plots. These show that, aside from undersimulation during model start up, parallel lines can be drawn to the lines of one-to-one correspondence of measured and simulated values. Sediment simulation errors on Oklahoma Watersheds C-4 and C-5 were found to be significantly related to errors in their respective hydrology calibrations.
W86-03825

PROCEEDINGS OF THE CONFERENCE ON COASTAL EROSION AND WETLAND MODIFICATION IN LOUISIANA: CAUSES, CONSEQUENCES, AND OPTIONS.
Louisiana Universities Marine Consortium, Chauvin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-152777. Price codes: A12 in paper copy, A01 in microfiche. Conference held October 5-7, 1981, Baton Rouge, Louisiana. FWS/OBS-82/59, September 1982. Edited by Donald F. Boesch. 256 p.

Descriptors: *Wetlands, *Erosion, *Louisiana, Bank erosion, Erosion control, Erosion rates, Marshes, Coastal marshes, Salt marshes, Tidal marshes, Management planning, Planning, Sea level, Fisheries, Waterfowl.

The causes and consequences of coastal erosion and wetlands modification in Louisiana, and the mitigative options to slow the loss of coastal lands are discussed. Specific topics covered include sedimentation and sea-level rise, geological and human factors, mudflat and marsh progradation, canal dredging, the effects of coastal alteration on marsh plants, effects of wetlands deterioration on fish and wildlife resources, economic aspects of land loss, future sea-land changes, dune vegetation and stabilization, and reversal of coastal erosion by rapid sedimentation and shoreline in Louisiana during the early 1980's was 130 sq km/yr. (Halterman-PTT)
W86-03850

SEDIMENTATION AND APPARENT SEA-LEVEL RISE AS FACTORS AFFECTING LAND LOSS IN COASTAL LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
R. H. Baumann, and R. D. DeLaune.
IN: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, October 5-7, 1981, Baton Rouge, Louisiana. FWS/OBS-82/59, September 1982. p 2-13, 5 fig, 14 ref.

Descriptors: *Wetlands, *Marshes, Coastal marshes, Salt marshes, Sea level, Water level, *Louisiana, Accretion.

The conversion of marsh to open water habitat as a result of natural phenomena is discussed. Rates of apparent sea-level dating, artificial marker horizons, and water level data. The study sites are not vertically accreting at a rate needed to maintain intertidal elevation, and have subsequently been subjected to net submergence since at least the mid-1950's. Rates of apparent sea-level rise at the two study areas were 1.2 and 1.3 cm/yyr from 1954 to present. Sedimentation rates through the same period were approximately 0.7 cm/yr over most of the area of investigation, though streamside marshes aggraded at a rate of 1.35 cm/yr. The transformation of marsh to open water will be complete in a few decades if present trends continue. A research strategy that will narrow management alternatives is briefly outlined. (Halterman-PTT)
W86-03851

ASSESSMENT OF GEOLOGICAL AND HUMAN FACTORS RESPONSIBLE FOR LOUISIANA COASTAL BARRIER EROSION,
Louisiana Geological Survey, Baton Rouge.
S. Penland, and R. Boyd.
IN: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, October 5-7, 1981, Baton Rouge, Louisiana. FWS/OBS-82/59, September 1982. p 14-38, 24 fig, 22 ref.

Descriptors: *Erosion, Bank erosion, *Beach erosion, *Louisiana, Erosion control, Erosion rates, Management planning, Planning, Louisiana, Sea level.

Coastal barrier land loss and sediment loss are described and modeled. Land loss results from the natural process of deltaic transgression and marine erosion, combined with the impact of human development. A three-stage model is described for the evolution of abandoned Mississippi deltas. Coastal barrier sediment loss, hence land loss, is attributed to several mechanisms, including longshore loss into spits and tidal deltas, landward loss through overwash and a subsiding lagoon, offshore loss due to an inequality in offshore/onshore transport capacity, and subsidence of the deltaic sand sources. Human impacts are also discussed. (Halterman-PTT)
W86-03852

MUDFLAT AND MARSH PROGRADATION ALONG LOUISIANA'S CHENIER PLAIN: A NATURAL REVERSAL IN COASTAL EROSION,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
J. T. Wells, and G. P. Kemp.
IN: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, October 5-7, 1981, Baton Rouge, Louisiana. FWS/OBS/82/59, September 1982. p 39-51, 6 fig, 16 ref.

Descriptors: *Sedimentation, *Sea level, *Louisiana, Water level, Silting, Deposition, Suspended load, Sediments, Silt, Mud, Mud flats.

The new influx of fine-grained sediment into the chenier plain coast of southwestern Louisiana is discussed. A major ramification of this is localized coastal progradation along what had previously been the most rapidly retreating shoreline in the United States. Silts and clays from the Atchafalaya River are now accumulating as mudflats along the coast. These transitory mudflats provide a buffer to incoming storm waves and serve as a temporary storehouse for littoral sediments. Accelerated growth of the chenier plain is expected when the subaerial Atchafalaya Delta outgrows Atchafalaya Bay, thus allowing an even greater volume of sediments to enter the dynamic shelf region seaward of the bay. The present coastal erosion is expected to reverse within 50 to 100 years. (Halterman-PTT)
W86-03853

WETLAND LOSS DIRECTLY ASSOCIATED WITH CANAL DREDGING IN THE LOUISIANA COASTAL ZONE,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 6G.
W86-03854

CANALS AND WETLAND EROSION RATES IN COASTAL LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 6G.
W86-03855

LEGAL IMPLICATIONS OF COASTAL EROSION IN LOUISIANA,
Louisiana State Univ., Baton Rouge. Sea Grant Legal Program.
For primary bibliographic entry see Field 6E.
W86-03860

EFFECTS OF COASTAL STRUCTURES ON SHORELINE STABILIZATION AND LAND LOSS - THE TEXAS EXPERIENCE,
Texas Univ. at Austin. Bureau of Economic Geology.
For primary bibliographic entry see Field 2L.
W86-03863

SAND DUNE VEGETATION AND STABILIZATION IN LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
I. A. Mendelssohn.
IN: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, October 5-7, 1981, Baton Rouge, Louisiana. FWS/OBS-82/59, September 1982. p 187-207, 16 fig, 26 ref.

Descriptors: *Beach erosion, *Barrier Island, *Louisiana, *Erosion control, Louisiana, Erosion, Sea level, Environmental effects, Water level, Bank erosion, Vegetation effects, Vegetation.

Louisiana's barrier dune vegetation, and its use for dune building and stabilization on Timbalier Island is discussed. Previously, the use of hard structures, such as groins, jetties, and seawalls, to control or reduce barrier island erosion in Louisiana had met with limited success. The use of vegetation to stabilize substrates offers a sound alternative to the hard structure approach to erosion abatement. The importance of this program is discussed, with a focus on marine processes which erode the abandoned delta and concentrate a restricted quantity of coarse-grained sediments into highly mobile barrier islands, spits, and beaches which overlie unconsolidated delta silts and clays. Subsequent subsidence in concert with a eustatic increase in sea level, generates a rapid apparent sea-level rise, equivalent to 1 m/100 yr. This process has produced a very serious barrier island erosion problem. (Halterman-PTT)
W86-03864

REVERSAL OF COASTAL EROSION BY RAPID SEDIMENTATION: THE ATCHAFALAYA DELTA (SOUTH-CENTRAL LOUISIANA),
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
H. H. Roberts, and I. I. I. Van Heerden.
IN: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, October 5-7, 1981, Baton Rouge, Louisiana. FWS/OBS-82/59, September 1982. p 214-231, 14 fig, 14 ref. DACW 29-77-C-0163.

Descriptors: *Sedimentation, *Deposition, *Sea level, *Louisiana, *Marshes, *Deltas, Benefits, Flood data, Flood discharge, Flow discharge, Flooding, Mississippi River, Atchafalaya River.

Systematic monitoring of changes within the delta system of the Atchafalaya Bay over a four year period has shown that delta growth is proportional to flood volume and duration. Land loss was reversed during a major flood in 1979. The formation of deltas by channel bifurcation and bar fusion in several areas has elevated water levels near the coast during floods, causing sediment-rich water to be transported into surrounding marshes. New growth is evident at the downdrift chenier plain, and appears to be a result of rapid sedimentation since the 1950's. (Halterman-PTT)
W86-03865

2K. Chemical Processes

HYDROCHEMICAL AND ISOTOPIC CONTENT OF BASALT GROUNDWATERS BENEATH THE HANFORD SITE, WASHINGTON,
Rockwell International, Richland, WA. Energy Systems Group.
F. A. Spane, D. L. Graham, and R. W. Bryce.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-015795. Price codes: A03 in paper copy, A01 in microfiche. RHO-BW-SA-190, March 1982. 26 p, 10 fig, 10 tab, 19 ref. DE-AC06-77RL01030.

Descriptors: *Geochemistry, *Water analysis, Radioactive waste disposal, Groundwater movement, Basalt Waste Isoloation Project, Columbia River, Hanford Site, Washington, Baseline studies, Spatial variation, Isotope studies.

Major inorganics, trace elements, dissolved gas, and stable and unstable isotopes were studied in basaltic groundwaters involved with the Basalt Waste Isolation Project, Columbia River basin. Three groundwaters were sampled: Saddle Mountains (sodium-calcium bicarbonate type), Wanapum (sodium bicarbonate-chloride type), and Grande Ronde (sodium chloride type). Vertical and areal variations occurred within short intervals. The hydrochemical differences exhibited for the basalt formations are attributable to variations in groundwater residence time, geochemistry of the flow continuum, and thermodynamic relationships that control rock/water interactions. The overall dilute nature and low concentration of conservative constituents in groundwater within the Saddle Mountains Basalt suggest a local origin for these shallow basalt groundwaters. In comparison, increased chloride, fluoride, and sulfate and decreased carbonate content with depth, indicate that groundwaters in the Grande Ronde Basalt are part of an intermediate to regional groundwater flow system. (Cassar-PTT)
W86-03517

GEOCHEMISTRY AND GEOHYDROLOGY OF THE WEST DECKER AND BIG SKY COAL-MINING AREAS, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
R. E. Davis.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4225, 1984. 109 p, 31 fig, 14 tab, 35 ref.

Descriptors: Spoil banks, *Strip mine wastes, Strip mines, Coal mines, *Groundwater, Impaired water quality, *Water levels, *Dissolved solids, West Decker Mine, Big Sky Mine, *Montana.

In the West Decker Mine area, water levels west of the mine at post-mining equilibrium may be almost 12 feet higher than pre-mining levels. Dissolved-solids concentration in water from coal aquifers is about 1,400 milligrams per liter and from mine spoils is about 2,500 milligrams per liter. About 13 years will be required for ground water moving at an average velocity of 2 feet per day to flow from the spoils to the Tongue River Reservoir. The increase in dissolved-solids load to the reservoir due to mining will be less than 1 percent. In the Big Sky Mine area, water levels at post-mining equilibrium will closely resemble pre-mining levels. Dissolved-solids concentration in water from coal aquifers is about 2,700 milligrams per liter and from spoils is about 3,700 milligrams per liter. About 36 to 60 years will be required for ground water moving at an average velocity of 1.2 feet per day to flow from the spoils to Rosebud Creek. The average annual increase in dissolved-solids load to the creek due to mining will be about 2 percent, although a greater increase probably will occur during summer months when flow in the creek is low. (USGS)
W86-03545

OCCURRENCE AND DISTRIBUTION OF FLUORIDE IN GROUNDWATERS OF KENYA,
Nairobi Univ. (Kenya). Dept. of Dental Surgery.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 75-86, 4 fig, 2 tab, 18 ref.

Descriptors: *Geochemistry, *Water pollution sources, *Fluorides, *Water quality, *Groundwater, Water supply, Public health, Boreholes, Wells, Kenya, Rift Valley, Water pollution effects.

Water samples from 1286 boreholes from different parts of Kenya were analyzed for their fluoride concentrations. The majority of the samples (61.4%) had fluoride ion concentrations above 1.0 parts per million, while 19.5% had above 5.0 ppm. Excess levels of fluoride were found to occur in most parts of the country, especially in the Nairobi, Rift Valley, Eastern and Central Provinces which contain approximately 59.5% of Kenya's population. The high fluoride areas tended to coincide with the geographic locations of volcanic rock in and around the Rift Valley region. It was also observed that the deeper the boreholes, the greater the tendency for higher concentration of fluoride in groundwater. The findings show that there is need to defluoridate groundwater in most regions of the country for the health of the majority of the Kenyan population if, as demanded by the increase in population, groundwater resources are to be exploited. (Author)
W86-03569

HYDROCHEMICAL BALANCES OF FRESHWATER SYSTEMS: PROCEEDINGS OF THE UPPSALA SYMPOSIUM.
Naturvetenskapliga Forskningslaboratoriet i Studsvik, Nykoeping (Sweden).
For primary bibliographic entry see Field 5B.
W86-03753

ROLE OF NATURAL ORGANICS ON WATER INTERACTION WITH SOIL AND ROCK,
Kiel Univ. (Germany, F.R.).
G. Matthess.
In: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 11-21, 36 ref.

Descriptors: *Soil water, *Chemical properties, *Organic acids, *Groundwater, *Geochemistry, *Geohydrology, *Humic acids, Biochemistry, Organic compounds, Organic matter, Soil organic matter, Biodegradation, Percolation, Groundwater pollution, Soil horizons, Adsorption.

The geochemical, physical and biological processes which control the interaction between the subterranean water and the solid phases in the unsaturated and saturated zones are affected in many respects by the presence of solid or dissolved organic matter. Organic substances in the Earth's crust are derived from biological materials. Humic substances are the major organic constituents of soils and sediments. The non-humic substances in soils and sediments are carbohydrates, proteins, peptides, amino acids, fats, waxes, and low molecular weight organic acids. The geochemical processes that are affected by the presence of organic substances are solution-precipitation, acid-base reaction, oxidation-reduction, complexation, and adsorption-desorption. The biochemical processes that are affected by organic substances are biochemical degradation and cell synthesis. The physical processes that are influenced by organic substances are advection, dispersion, filtration, and gas transport. The geochemical and biochemical reactions during percolation of infiltrated rainwater through the unsaturated zone down to groundwater table establish the quality of the underlying groundwater. The content of dissolved organic substances increases in the seepage water of the organic horizons of the soils. The contents of oxidizable organic substances are partly controlled by the vegetation or type of tree cover.
W86-03754

INTERACTION WATER-SILICATE MINERALS IN THE UNSATURATED ZONE CONTROLLED BY THERMODYNAMIC DISEQUILIBRIA,
Kiel Univ. (Germany, F.R.).
W. Ohse, G. Matthess, A. Pekdeger, and H. D. Schulz.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 31-40, 6 fig, 9 ref.

Descriptors: *Minerals, *Silica, *Kaolinite, *Glacial sediments, *Silicates, *Sediment-water interfaces, *Interstitial water, *Thermodynamics, Sediments, Computer models, Clay minerals, Subsoil, Soil horizons, Chemical properties, Aeration zone.

Pore waters from the unsaturated zone of Quaternary glacial outwash sediments were won by centrifugation. Mineral stabilities of the main silicate minerals with respect to dissolved inorganic species were carried out on the basis of chemical thermodynamics with the computer program WATEQF (Plummer et al., 1976). The calculations show tendencies of mineral disequilibria, which result in corroded grain surfaces or in precipitates as detected by scanning electron microscopy (SEM) and energy dispersive analysis of X-rays (EDAX). Below the weathered zone the pore waters approach saturation with respect to feldspar, mica and amorphous silica, whereas quartz oversaturation exists in the total profile. The undersaturation of the pore waters with respect to feldspar in the top horizons is combined with a relative enrichment of kaolinite in these sediments. After a weathering period of about 60,000 years a general decrease of the corrosion state of feldspars, dependent upon saturation state of pore waters versus depth, is established. (Author)
W86-03756

HYDROGEOCHEMICAL EVOLUTION AND VARIABILITY OF GROUNDWATER IN EXPERIMENTAL BASINS OF S. W. WESTERN AUSTRALIA,
For primary bibliographic entry see Field 2F.
W86-03757

COMPARATIVE STUDY OF SEQUENTIAL REDOX PROCESSES IN THREE BRITISH AQUIFERS,
British Geological Survey, Wallingford (England).
For primary bibliographic entry see Field 2F.
W86-03758

SIMULATION OF PHYSICOCHEMICAL INTERACTIONS IN A WATER-ROCK SYSTEM IN ASSESSING GROUND-WATER QUALITY,
Vsesoyuznyi Nauchno-Issledovatel'skii Inst. Gidrogeologii i Inzhenerdoi Geologii, Moscow (USSR).
G. S. Vartanyan, S. R. Krainov, and G. V. Kulikov.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 71-78, 3 fig, 19 ref.

Descriptors: *Physicochemical properties, *Water quality, *Simulation analysis, *Thermodynamics, *Chemical reactions, *Groundwater hydrology, *Theoretical analysis, *Earth-water interfaces, Groundwater, Rocks, Model studies, Geohydrology, Mathematical studies, Chemical properties.

Principles of simulating physicochemical interactions in a water-rock system are discussed. It is shown that simulation of this kind provides close agreement between estimated and real distributions of elements in groundwater. Thus, the simulation can be used in theoretical studies of hydrochemical processes and for predicting changes in groundwater chemical composition. Maximum agreement between estimated and real distributions of elements in groundwater is attained by approximating existing water-rock systems to state of chemical equilibrium. The degree of this approximation increases with a decrease in the rate of groundwater seepage, as well as with an increase in groundwater temperature and in the ratio between solid and liquid phases (S/L ratio). In non-equilibrium systems, simulation results may indicate the trends and final effects of the processes occurring in the system during its evolution to equilibrium. Quantitative agreement between simulation data and real concentrations of elements in non-equilibrium systems may be reached by using algorithms comprising the principles of chemical thermodynamics, physicochemical hydrodynamics and kinetics, making allowance for the strong impact which the HGD (hydrogeodeformation) earth field has on these processes. (Author)
W86-03759

SOME IMPLICATION OF THE ROLE OF KINETICS IN ENHANCING ELEMENT TRANSPORT,
Nairobi Univ. (Kenya). Dept. of Geology.
M. P. Tole.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 79-86, 4 fig, 10 ref.

Descriptors: *Thermodynamics, *Model studies, *Metals, *Chemical precipitation, *Earth-water interfaces, *Geochemistry, *Kinetics, *Leaching, Models, Hydrologic models, Minerals, Chemical reactions, Dissolved solids, Geohydrology, Mathematical studies, Chemical properties, Leachates.

Thermodynamic methods have been used to predict the quantities of elements that can be transported in solution under various conditions of temperature, pressure, and solution composition. Recent studies show that equilibrium is often not attained under conditions prevalent during the dispersion of metals away from ore deposits. Based on silicate dissolution studies, a dissolution precipitation model was derived to explain observed mineral-water interaction kinetics. With this method, the rate of release of elements from the solid mineral during dissolution is initially linear with time, until saturation with respect to another solid phase containing the released elements is attained. Two processes then become operative - a continued release (linear rate) of the elements from the dissolving mineral, and removal of the released elements by precipitation. These relations give rise to a kinetic contribution to the quantities of metals in solution over and above those that would be predicted by thermodynamics alone. The magnitude of this kinetic enhancement factor is dependent upon the relative magnitudes of the dissolution rate constant for the dissolving mineral and the precipitation rate constant for the precipitated mineral and can be of the same order of magnitude (or more) as the thermodynamic equilibrium factor. A systematic study of mineral-solution interaction kinetics is required to provide basic data to enable the prediction of the processes of leaching of ore deposits and the concentrations of metals to be expected in solution during geochemical studies.
W86-03760

HYDROCHEMICAL PROCESSES IN GROUNDWATER DISCHARGE AREAS,
Uppsala Univ. (Sweden).
For primary bibliographic entry see Field 2F.
W86-03762

RESPIRATORY GAS CONTENT (O2 AND CO2) AND IONIC COMPOSITION OF RIVER WATER IN THE PLAIN OF ALSACE (EASTERN FRANCE),
Centre National de la Recherche Scientifique, Strasbourg (France). Lab. de Physiologie Respiratoire.
For primary bibliographic entry see Field 2F.
W86-03763

HYDROCHEMISTRY OF SPRINGS FROM DOLOMITE REEFS IN THE SOUTHERN ALPS OF NORTHERN ITALY,
Vrije Univ., Amsterdam (Netherlands).
C. A. J. Appelo, H. E. Beekman, and W. A. Oosterbaan.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 125-138, 7 fig, 2 tab, 14 ref.

Descriptors: Minerals, *Calcium, *Magnesium, *Springs, *Isotopic tracers, *Dolomite, *Water chemistry, *Geohydrology, *Chemical properties, Chemical reactions, Geologic fractures, Aquifers, Carbon dioxide, Isotope studies, Groundwater, Geochemistry.

The evolution of spring water composition for pure dolomite rock of Northern Italy was studied using data on dissolution kinetics from laboratory experiments and carbon isotopes to determine reaction mechanisms. Ca/Mg ratios of spring water show congruent dissolution of dolomite. Surface water sampled at high altitudes before infiltration into the dolomite has low Ca and Mg concentrations and lower than atmospheric CO2 pressures. Concentrations of these minerals in springs around the reefs and delta C13-values in a number of springs are consistent with open system dissolution during flow through fissures from high altitude to spring level. Therefore, the fissures must be large enough to permit air circulation. Dissolution experiments with polished dolomite slabs immersed in water charged with air for a period of two months confirmed a rapid rate of dissolution for dolomite. Under field conditions, only a few days would be needed to reach concentrations of dolomite near saturation. Some springs have lower delta-C13 levels and show small Ca and Mg concentration increases. Such springs are considered to reflect an additional flow component due to the drainage of vegetated soil in the area surrounding the reef.
W86-03765

DESIGN OF A HYDROCHEMICAL DATA COLLECTION PROGRAMME,
Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.
For primary bibliographic entry see Field 7A.
W86-03767

RELIABILITY OF INFORMATION IN HYDROGEOCHEMICAL INVESTIGATIONS,
Akademiya Navuk BSSR, Minsk.
For primary bibliographic entry see Field 7A.
W86-03769

CONDITIONS AND FREQUENCY OF SAMPLING FOR ELUCIDATIONS OF TRANSPORT MECHANISMS AND ELEMENT BUDGETS IN UPLAND DRAINAGE BASINS,
Aberdeen Univ. (Scotland). Dept. of Soil Science.
For primary bibliographic entry see Field 7A.
W86-03770

USE OF DIFFERENT PHYSICAL SEPARATION TECHNIQUES FOR TRACE ELEMENT SPECIATION STUDIES IN NATURAL WATERS,
Oslo Univ. (Norway). Dept. of Chemistry.
B. Salbu, E. Steinnes, and H. Bjornstad.
In: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 203-213, 3 fig, 1 tab, 21 ref.

Descriptors: *Trace elements, *Water analysis, *Separation techniques, *Ultrafiltration, *Electrodialysis, *Electrophoresis, *Gels, *Centrifugation, Membrane filters, Dialysis, Membrane processes, Chemical properties.

Hydrochemical balance studies require knowledge of the speciation of the elements concerned, namely the distribution between soluble and suspended forms and among different soluble species. The separation of truly soluble forms of trace elements from the fraction associated with the particulate phase in natural freshwater is usually not possible by membrane filtration. Alternative techniques such as ultrafiltration, centrifugation, dialysis in situ or in the laboratory, electrodialysis, free-liquid electrophoresis, gel filtration, or a combination of separation steps based on these techniques are required. Each of these separation techniques is critically evaluated with respect to its feasibility for speciation studies in natural waters. In general, separations that can be carried out at the sampling site are preferable. Choosing the proper combination of separation techniques to characterize the systems involved will become increasingly important and more analytical work is needed in this field.
W86-03771

MASS-BALANCE APPROACH TO THE UNDERSTANDING OF GEOCHEMICAL PROCESSES IN AQUEOUS SYSTEMS,
Ustredni Ustav Geologicky, Prague (Czechoslovakia).
For primary bibliographic entry see Field 5B.
W86-03773

PHYSICO-CHEMICAL CHARACTERISTICS OF SURFACE WATERS AND HYDROLOGICAL BEHAVIOR OF A SMALL GRANITIC BASIN (VOSGES MASSIF, FRANCE): ANNUAL AND DAILY VARIATIONS,
Centre National de la Recherche Scientifique, Strasbourg (France). Centre de Sedimentologie et de Geochimie de la Surface.
For primary bibliographic entry see Field 5B.
W86-03775

GEOCHEMICAL STUDIES IN THE DRAINAGE BASIN OF THE RIO VOUGA (PORTUGAL). I. GENERAL HYDROGEOCHEMISTRY FROM ITS ORIGIN TO THE RIA DE AVEIRO,
Utrecht Rijksuniversiteit (Netherlands).
C. H. Van der Weijden, H. L. Ten Haven, H. A. Boer, C. F. A. Hopstaken, and S. P. Vriend.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 263-276, 7 fig, 3 tab, 9 ref.

Descriptors: *Geochemistry, *Geohydrology, *Chemical properties, *Trace elements, *River basins, *Weathering, *Estuaries, *Minerals, Aluminum, Manganese, Iron, Fertilizers, Rocks, Water analysis, Hydrologic data collections.

A hydrogeochemical survey in the drainage basin of the Rio Vouga (Portugal) was carried out during the summer of 1981. Waters and composite rock samples were analyzed for major constituents and some trace elements. The dominant rock types of the basin are granite and metasediments. A comparison of water and rock chemistry, using discriminant function analysis of the data obtained on the water chemistry, showed that distinction between granitic and metasedimentary waters is possible. However, partial weathering of rock-forming minerals as well as contributions of marine aerosols and of fertilizers to the water chemistry obfuscate straightforward relationships. A brief survey of water chemistry in the Ria de Aveiro revealed that the elements Al, Fe, and Mn behave conservatively during estuarine mixing, which is probably caused by conservative mixing of colloidal matter in this lagoon. (Author)
W86-03776

EVALUATION OF THE INTENSITY OF SOME RECENT EXOGENIC GEOLOGICAL PROCESSES IN THE U.S.S.R. BY THE HYDROGEOCHEMICAL BALANCES METHOD,
Akademiya Nauk SSSR, Moscow. Geologicheskii Inst.
V. P. Zverev.

IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 277-285, 7 tab, 8 ref.

Descriptors: *Geochemistry, *Weathering, *Kinetics, *Groundwater, *Chemical reactions, *Geohydrology, *Subsurface water, *Mineral water, Rocks, Minerals, Hydrologic data collections, Chemical properties, River basins, Leaching.

A study of the hydrogeochemical balance in the territory of the U.S.S.R. and its separate regions enabled a regional evaluation to be made of the role of subsurface waters in the redistribution of matter in the upper parts of the earth's crust. The intensity of the processes of chemical weathering of the major types of rock-forming minerals was calculated for large platform and mountain-folded regions. The kinetics of chemical weathering and formation of secondary products was obtained from detailed hydrogeochemical balance investigations of key areas. In interactions between subsurface waters with mountain rocks, a transformation of the latter takes place. As a result, chemical elements, in strictly definite amounts for each case, pass into a solution and form a subsurface constituent of the hydrogeochemical balance of separate ions. The hydrogeochemical balance was used for the quantitative estimation of discharge of subsurface waters with an abnormal chemical composition on the basins of the rivers Velichshai and Tutkhun. The balance method allowed the investigation of the natural discharge of thermomineral and mineral waters. The data obtained agreed well with estimations of reserves of types of subsurface waters studied by means of the hydrodynamic method.
W86-03777

STUDY OF THE HYDROCHEMICAL REGIME AND ITS LONG-TERM VARIATIONS IN THE CASE OF SOME RIVERS IN U.S.S.R.,
Hydrochemical Inst., Rostov-na-Donu (USSR).
A. M. Nikanorov, and V. V. Tsirkunov.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 287-293, 3 fig, 1 tab, 6 ref.

Descriptors: *Anions, *Cations, *Ions, *Seasonal variation, *Geochemistry, *Dissolved solids, *Rivers, *Ion transport, Baseline studies, Salinity, Chemical properties, Water analysis, Water quality, Hydrologic data collections, Water pollution effects.

Seasonal and long term (1950-1980) variations in concentrations of major cations and anions for 10 large rivers in the U.S.S.R. were studied along with the relation between hydrochemical and hydrological regimes and transport of major ions. The basic method of investigation of long-term variations was detection of linear trends from the records of flow-weighted annual concentrations. For 13 rivers for which 20-yr water quality records were available and which were not associated with major sources of pollution (background rivers) linear trends were found to be insignificant, with relative values of 1.0-1.5%. A tendency towards an increase in concentration of chloride may be explained by the start of anthropogenic impact, which may change the low concentration of background rivers. In the rivers Don, Kura and Terek, the relative value of linear trends for Cl(-), SO4(--), Na(+) and K(+) was 2-4%. Insignificant negative trends were observed for the rivers Yenisei, Lena and Ob. In rivers exposed to heavy anthropogenic impact, an increase (by 10-40%) of the major ions transport was observed in spite of the considerable (25-35%) decrease in water flow. The greatest increase was observed in the transport of Cl(-), SO4(--), and Na(+) and K(+).
W86-03778

STUDY OF ANTHROPOGENIC INFLUENCE ON WATER QUALITY IN SOME RIVERS OF THE BALTIC SEA BASIN,
Gosudarstvennyi Gidrologicheskii Inst., Leningrad (USSR).
For primary bibliographic entry see Field 5B.
W86-03779

HYDROCHEMICAL BUDGETING IN STUDIES OF GROUND-WATER RENEWABILITY IN AREAS OF GLACIAL FORMATION SYSTEMS,
Polish Academy of Sciences, Warsaw. Geological Sciences Inst.
For primary bibliographic entry see Field 2F.
W86-03783

MODEL EXPERIMENTAL STUDY OF HYDROCHEMICAL PROCESSES IN THE SATURATED ZONE,
Higher Inst. of Mining and Geology, Sofia (Bulgaria).
B. L. Velikov.
In: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 359-367, 4 fig, 3 tab, 11 ref.

Descriptors: *Heavy metals, *Cations, Water pollution sources, *Saturated zone, *Hydrologic models, *Organic acids, *Ion transport, *Fate of pollutants, Groundwater movement, Groundwater recharge, Humic acid, Fulvic acid, Ions, Models, Model studies, Mathematical models, Water pollution.

Results are presented from a model study carried out under dynamic conditions, of the migration of heavy-metal ions Mn(2+), Ni(2+), Cu(2+), Zn(2+), Cd(2+), Hg(2+), Pb(2+), and Fe(3+), with and without natural chelate-forming agents (dissolved humic acids) in order to study the role of various hydrochemical processes, mainly in the saturated zone of alluvial aquifers. The collected data are interpreted according to the recently developed techniques of 'the three characteristic points.' The elimination (binding) forms of the heavy-metal ions with the filtration medium were analyzed with the aid of a differential extraction sequence. Results indicated that in the presence of dissolved humic (fulvic) acids as normal hydrogeochemical ingredients, homogeneous chelate formation prevails, thereby reducing the filtration medium - water interactions and thus increasing the migration capability of these toxic inorganic pollutants. The modified extraction sequence as well as the analyses of the solid-phase composition and tests of the influence of migration forms on plant uptake aid in more satisfactory prediction of the hazard posed by secondary metal-ion remobilization and pollution. The present study may also be of use in predicting hydrochemical processes for the artificial recharge of groundwater reserves and their purification to obtain potable supplies.
W86-03785

SALINE GROUNDWATER DISCHARGES FROM CRYSTALLINE ROCKS NEAR THUNDER BAY, ONTARIO, CANADA,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2F.
W86-03786

HYDROCHEMICAL RELATIONSHIPS BETWEEN RAINWATER, FLOODS, GROUNDWATER AND LITHOLOGY IN THE AVEDAT GROUP ON THE NEGEV HIGHLANDS, ISRAEL,
Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.
For primary bibliographic entry see Field 2A.
W86-03789

ADVANCES IN THE IDENTIFICATION AND ANALYSIS OF ORGANIC POLLUTANTS IN WATER, VOLUME 1.
For primary bibliographic entry see Field 5A.
W86-03791

2L. Estuaries

CURRENTS IN SUISUN BAY,
California Univ., Berkeley. Dept. of Civil Engineering.
R. A. Denton.
Publication No. 85-3wr, September, 1984. 226 p. 18 fig, 20 ref, 12 append.

Descriptors: *Water currents, *Bays, *Hydrodynamics, *Tides, Aquatic habitats, Data processing, Conductivity, Flushing, Water pollution effects, Time series analysis, Water quality standards, *California.

This is the second report in a planned series on the hydrodynamics of the San Francisco Bay. A number of changes have been proposed for Suisun Bay that could have an effect on the water quality in the region, for example, a proposed deepening of the shipping channel, a suggested tidal barrier, and a proposed San Luis Drain into the bay near Chipps Island. These factors illustrate the need for a better understanding of the hydrodynamics in Suisun Bay. The hydrodynamic circulation in Suisun Bay is typical of a progressive wave in a partially mixed estuary. The main flows are along a few well-defined channels, separated by shallow gravel banks and mud flats, and also occur between islands. Evidence is found of tidal trapping in Grizzly Bay. There is a difference in the phase of the tidal currents going into Grizzly Bay and those passing through the Suisun Cutoff north of Ryer Island. The net effect of these phase differences when averaged over a tidal cycle is to increase the dispersion of pollutants. The data processing and archiving techniques used were developed for an earlier report on the current in the South San Francisco Bay. The original data were first converted into a standard 30-minute averaged file for each meter deployment. Time series plots, Eulerian progresive vector diagrams, and current roses were prepared. The current and conductivity data provide a substantial base for further analyses of flushing mechanisms. (Fazio-Omniplan)
W86-03448

CURRENTS IN SAN PABLO BAY,
California Univ., Berkeley.
R. A. Denton.
California State Water Resources Control Board, Sacramento Aquatic Hiabitat Program, Publication No. 85-4wr, March, 1985. 51 p. 28 fig, 17 ref, 6 append.

Descriptors: *Water currents, *Bays, *Flow characteristics, *Wind velocity, *Current meters, *Hydrologic data collections, Flushing, Water pollution effects, Tides, Tidal currents, Saline water intrusion, Salinity, Density currents, *California.

Eleven stations in San Pablo Bay were deployed in March-May 1979 and May-November 1980 to provide seasonal measurements and variations of current, conductivity, temperature and salinity. The average tidal current cycle can be used to model the typical tidal excursions and mean residual currents for studies of pollutant dispersion and its effect on the bay's ecology. San Pablo Bay has two main flows bordered by large mudflat areas. It also has significant salt and brackfish tidal marshes which support numerous food organisms. Seasonal changes in salinity cause seasonal changes in fish populations; larger freshwater inflows in winter allow more freshwater fish varieties to extend seaward. The bay's flow is typical of a progressive wave in a partially mixed estuary, with the slack velocities occuring several hours after high and low tide and at different times along the main channel and the shallow area to the north. The exchange between the strong main channel flows and the weaker flows in the shallows increases the longitudinal dispersion of pollutants in the main channel. Conversely, pollutants released in the shallows will take a relatively long period to be dispersed and diluted. Pollutant dispersion is usually only critical during periods of low Delta outflow. The current and conductivity data provide a substantial base for further analyses of flushing mechanisms. Suggestions for future research include studying the correlation between tidal elevation, flow velocity and salinity, and the effect of wind stresses on the flushing process and on residual currents in the shallows. (Atkins-Omniplan)
W86-03449

VERIFICATION OF THE CHESAPEAKE BAY MODEL: CHESAPEAKE BAY HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
N. W. Scheffner, L. G. Crosby, D. F. Bastian, A. M. Chambers, and M. A. Granat.
Technical Report HL-81-14, December 1981. Final Report. 275 p, 33 fig, 8 tab, 4 append, 14 ref.

Descriptors: *Chesapeake Bay, *Hydraulic models, *Estuaries, *Model testing, *Salinity currents, *Tidal hydraulics, Bays, Tides, Models, Model studies, Salinity, Hydrographs, Tidal currents, Saline-freshwater interfaces, Tributaries, Rivers.

The Chesapeake Bay model, a fixed-bed model constructed to a horizontal scale ratio of 1:1000 and a vertical scale ratio of 1:1000, reproduced the Chesapeake Bay from the ocean to the head of tides for each tributary. Reproduction extended to the +20 ft contour. The model was equipped with the necessary appurtenances to reproduce accurately and measure tidal heights, tidal currents, salinity distributions, and freshwater inflows. Due to the immense size of the model (8.6-acre model housed in a 14-acre building), complete computer control and data aquisition capabilities were provided. Severe limitations in prototype data in addition to substantial wind contamination of those data necessitated a detailed data analysis program which resulted in a modified approach to physical model verification. This was accomplished in the following two separate modes of operation: verification for tidal heights and tidal velocities using an M2 constituent tide and a constant long-term freshwater inflow, and verification for salinities using a typical 28-day tidal cycle (with long-period wind energy filtered out) and inflow hydrographs reproduced in 2-wk time-steps. A bubbler system was incorporated in the model to statistically reproduce the vertical mixing caused by wind fields acting on the prototype. Excellent verification of the model was achieved. (Author)
W86-03459

SIMULATION OF ESTUARINE SILT TRANSPORT ACCORDING TO STORM WATER RUNOFF,
For primary bibliographic entry see Field 2J.
W86-03465

INLAND TRAVEL OF TIDE-DRIVEN SALINE WATER IN THE ALTAMAHA AND SATILLA RIVERS, GEORGIA, AND THE ST. MARYS RIVER, GEORGIA-FLORIDA,
Geological Survey, Doraville, GA. Water Resources Div.
M. H. Brooks, and J. B. McConnell.
, 1983. 17 p, 8 fig, 3 tab, 5 ref.

Descriptors: *Tidal rivers, *Saline water intrusion, *Specific conductivity, Low flow, *Spring tides, Altamalia River, Satilla River, *Georgia, Camden County, Glynn County, McIntosh County, Florida, Nassau County.

The inland travel of saline water from the ocean into the Altamaha and Satilla Rivers in Georgia, and the St. Marys River in Georgia-Florida, was investigated in November 1981. Abnormally high tides coupled with low river flows probably resulted in near maximum inland travel of saline water into these rivers. The maximum tide heights during the days of the investigations, measured by a tide-stage recorder at Fernandina Beach, Florida, were 6.3 feet (November 13) and 5.8 feet (November 14) above sea level. Mean daily flows of the Altamaha, Satilla, and St. Marys Rivers at stream-gaging stations in the vicinity of the study reaches were 2,080, 84, and 109 cubic feet per second, respectively. Specific conductance served as an indicator of ocean-derived saline water in the rivers and was used to determine the chlorinity gradients of the river reaches. The maximum distance saline water traveled inland during the high tides was about 24 river miles in the Altamaha River, 51.5 river miles in the Satilla River, and 40.2 river miles in the St. Marys River. (USGS)
W86-03561

ECOLOGICAL SOLUTIONS TO ENVIRONMENTAL MANAGEMENT CONCERNS IN THE PINELANDS NATIONAL RESERVE: PROCEEDINS OF A CONFERENCE,
Rutgers - The State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies.
Held on April 18-21, 1982. Camden/Cherry Hill, New Jersey, 47 p, December, 1982. Edited by Ralph E. Good. DEB-8200529.

Descriptors: *Pinelands National Reserve, *Ecology, *Environment, *Information exchange, Ecosystems, Wetlands, Forest fires, Nutrients, Water quality, Hydrology, Ecological distribution.

Pinelands ecosystems support 39 species of mammals, 59 species of reptiles and amphibians, 91 species of fish (including estuarine species), 299 species of birds and over 800 vascular plant taxa. Much of the area is still sparsely settled, at least by local criteria, although New York City and Philadelphia are both less than 100 miles away. In this sense the Pinelands represent an interesting cultural anomaly. The goal of the conference was to develop recommendations for an organized collection of ecological and environmental information about the Pinelands. There are two interrelated mandates for achieving this goal: (1) to provide a data base for initially formulating and subsequently justifying, even under the most intense scientific and legal scrutiny, the best management plan for the Pinelands, and (2) to enhance and further the science of ecology by understanding the population and ecosystem properties unique to the Pinelands, and by employing, where possible, reciprocal transfers of information to and from the Pinelands and other ecosystems. Clearly the best management plan will depend upon our understanding of the properties and processes of the Pinelands. This volume is a compilation of syntheses of the conference presentations with a brief text of background material.
W86-03616

MARICULTURE IN OLD RICE FIELD IMPOUNDMENTS: AN ANALOGY FOR DREDGED MATERIAL CONTAINMENT AREAS,
South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
J. M. Dean, C. A. Wilson, and N. C. Alon.
In: Aquaculture in Dredged Material Containment Areas: Proceedings, September 1982, Galveston, TX. Miscellaneous Paper D-83-2, October 1983. p 143-152, 1 fig, 4 ref.

Descriptors: *Ponds, *Dredging, *Fish ponds, *Fish farming, *Aquaculture, *Aquatic habitats, Lakes, Brackish water, Rice fields, Aquatic life, Aquatic animals, South Carolina, Estuarine environment, Minnows, Clams, Invertebrates, Scallops, Shellfish, Waterfowl, Ducks, Crabs, Oysters, Crawfish, Prawns, Shrimp.

Thousands of acres of South Carolina's estuarine coastline were impounded for rice production before the start of the twentieth century. This acreage, owned by private concerns, State agencies, and the Federal government, has been used for extensive aquaculture production since rice cultivation was abandoned. The most common use has been active management for waterfowl, and significant returns have been realized from hunting leases. Historically, a variety of organisms of interest to aquaculturists have been introduced into the ponds. Our research has shown that blue crabs, mullet, and shrimp survive at a higher rate and grow larger than do their wild counterparts. Additional studies have indicated that cage-grown oysters are also adaptable to rice-field culture. Other species, such as bait minnows, clams, and scallops, could be raised in the brackish water impoundments while prawns and crawfish would be suitable for freshwater impoundments. Experimental aquaculture has, so far, been limited to a very low management extensive type of culture. Dredged material containment areas (DMCA) would do better to combine intensive and extensive cultures. Existing impoundment aquaculture provides a management model, while the development and success of DMCA aquaculture would contribute to solving current impoundment problems. (Author)
W86-03711

PROCEEDINGS: 2ND ANNUAL GULF OF MEXICO INFORMATION TRANSFER MEETING.
Minerals Management Service, Metairie, LA. Gulf of Mexico OCS Regional Office.
For primary bibliographic entry see Field 10D.
W86-03841

PROCEEDINGS OF THE CONFERENCE ON COASTAL EROSION AND WETLAND MODIFICATION IN LOUISIANA: CAUSES, CONSEQUENCES, AND OPTIONS.
Louisiana Universities Marine Consortium, Chauvin.
For primary bibliographic entry see Field 2J.
W86-03850

SEDIMENTATION AND APPARENT SEA-LEVEL RISE AS FACTORS AFFECTING LAND LOSS IN COASTAL LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 2J.
W86-03851

ASSESSMENT OF GEOLOGICAL AND HUMAN FACTORS RESPONSIBLE FOR LOUISIANA COASTAL BARRIER EROSION,
Louisiana Geological Survey, Baton Rouge.
For primary bibliographic entry see Field 2J.
W86-03852

MUDFLAT AND MARSH PROGRADATION ALONG LOUISIANA'S CHENIER PLAIN: A NATURAL REVERSAL IN COASTAL EROSION,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 2J.
W86-03853

EFFECT OF COASTAL ALTERATION ON MARSH PLANTS,
Louisiana State Univ., Baton Rouge. School of Forestry and Wildlife Management.
R. H. Chabreck.
IN: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, October 5-7, 1981, Baton Rouge, Louisiana. FWS/OBS-82/59, September 1982. p 92-98, 1 tab, 11 ref.

Descriptors: *Marsh plants, *Wetlands, *Marshes, *Louisiana, Salt marsh, Coastal marshes, Salt tolerance, Saline water intrusion, Salinity, Vegetational effects, Environmental effects.

The Louisiana coastal marsh is subdivided into four vegetative types: saline, brackish, intermediate, and fresh. The types occur in bands generally paralleling the coastline and contain characteristic water salinity levels and plant communities. Activities of man coupled with natural processes, such as subsidence and erosion, have removed many natural tidewater barriers and reduced freshwater flow through the marshes. As a result, saltwater intrusion from the Gulf of Mexico has increased and the boundaries of vegetative types have been altered. The saline vegetative type has greatly increased in size and the brackish and intermediate types have shifted inland. This has caused a drastic reduction in the size of the fresh vegetative type. (Author)
W86-03856

EFFECTS OF WETLAND DETERIORATION ON THE FISH AND WILDLIFE RESOURCES OF COASTAL LOUISIANA,
Fish and Wildlife Service, Lafayette, LA.
D. W. Fruge.
IN: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, October 5-7,

1981, Baton Rouge, Louisiana. FWS/OBS-82/59, September 1982. p 99-107, 33 ref.

Descriptors: *Marshes, *Wetlands, *Coastal marshes, *Louisiana, *Environmental effects, Water fowl, Ducks, Geese, Fish, Shellfish.

Wetland deterioration, which is partially attributable to natural causes, has been greatly accelerated by human influences such as navigation channel, excavation, agricultural drainage, and construction of mainline Mississippi River levees that have presented freshwater and sediment overflow into adjacent subdelta marshes. The serious declines in estuarine-dependent fish and shellfish harvest, fur catch, waterfowl habitat, and related fish and wildlife productivity which would be caused by continued wetland deterioration are discussed. The magnitude of the use of these coastal wetlands by ducks, geese, fish and shellfish is described. The future of marsh restoration to be financed by the state of Louisiana through its Coastal Environmental Protection Trust Fund is discussed. (Halterman-PTT)
W86-03857

SOME CONSEQUENCES OF WETLAND MODIFICATION TO LOUISIANA'S FISHERIES,
Louisiana Dept. of Wildlife and Fisheries, Baton Rouge.
B. Barrett.
IN: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, October 5-7, 1981, Baton Rouge, Louisiana. FWS/OBS-82/59, September 1982. p 108-111, 5 ref.

Descriptors: *Wetlands, *Erosion, *Fisheries, *Louisiana, Fish, *Marshes, *Coastal marshes, Environmental effects, Dams, Reservoirs.

Agencies of the State and Federal Governments as well as local interests have long recognized that Louisiana's wetlands are undergoing adverse ecological changes. These changes are the result of both natural processes and the works of man. The dominant ecological change taking place in the coastal area is habitat alteration--wetlands are eroded and replaced by water. Now there are many proposals to reduce erosion rates which include freshwater introduction, jetties, and additional restrictions on activities. Freshwater introduction may be the most efficient means of reducing land loss rates. Fresh water, particularly from the Mississippi River, would reduce saltwater intrusion and contribute nutrients and sediments to the estuaries and wetlands. Changes in water regimes, however, could drastically alter animal populations as occurred in Sabine Lake. The water cycle was changed by the constructions of the Toledo Bend reservoir and dam which resulted in a drastic reduction in shrimp harvest in this lake. (Author)
W86-03858

WETLAND LOSSES AND COASTAL FISHERIES: AN ENIGMATIC AND ECONOMICALLY SIGNIFICANT DEPENDENCY,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
R. E. Turner.
IN: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, October 5-7, 1981, Baton Rouge, Louisiana. FWS/OBS-82/59, September 1982. p 112-120, 6 fig, 1 tab, 17 ref. Publication No CEL-SG-82-010.

Descriptors: *Wetlands, *Erosion, *Fisheries, *Economic aspects, *Louisiana, *Marshes, Coastal marshes, Environmental effects, Management planning, Cost analysis, Costs.

Louisiana's coastal fishing industry landings are limited by the area of coastal wetlands, not open water. The relationship is not sufficiently understood, but is demonstrable through the life history patterns of all the commercially important species, organism density in the vicinity of altered and natural wetland-water edges, experiments in predation, and correlation analysis of landings data and wetland area should be conserved in order to maximize for the largest potential fisheries yields. The impact of previous wetland losses are not well documented because of lack of good landings data that accounts for both year-to-year environmental influences and a changing fishing effort. At a projected 1% wetland loss rate over the next 20 years, the commercial fishing industry will experience a potential one billion dollar loss spread throughout the industry (exclusive of the recreational level). Thus with a mere 10% reduction in the present loss rates, the annual savings would be 5 million dollars. (Author)
W86-03859

ECONOMIC AND CULTURAL CONSEQUENCES OF LAND LOSS IN LOUISIANA,
Nicholls State Univ., Thibodaux, LA. Dept. of Earth Science.
For primary bibliographic entry see Field 6G.
W86-03861

FUTURE SEA LEVEL CHANGES ALONG THE LOUISIANA COAST,
Louisiana State Univ., Baton Rouge. Dept. of Geology.
D. Nummedal.
IN: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, October 5-7, 1981, Baton Rouge, Louisiana. FWS/OBS-82/59, September 1982. p 164-176, 7 fig, 1 tab, 41 ref.

Descriptors: *Sea level, *Water level, *Louisiana, Sediments, Tectonics, Model studies, Louisiana, Marine climates, Oceanography, Climates, Glaciations.

The relative elevation of sea and land has been changing throughout time in response to two fundamentally different groups of factors. Global factors include changes in the volume of the ocean basins due to tectonic processes and changes in the total amount of ocean water due to glaciation. Local factors include subsidence of continental margins and the compaction of recent sediments. During this century, global sea level (eustatic) appears to have been rising at a rate of 1.2 mm/yr. Along the south-central Louisiana coast the land surface appears to be sinking at a rate of about 8 mm/yr. Recent global climatic modelling strongly suggests that we are about to enter a period of rapid warming due to increased amounts of carbon dioxide in the atmosphere. As a consequence, eustatic sea-level rise is predicted to accelerate both because of steric expansion of the ocean water and continued melting of polar ice caps. For the next 40 years the eustatic sea-level rise may average 10 mm/yr. The local relative sea level in coastal Louisiana would therefore rise at about twice its present rate over this time period. At this rate local sea level will, in the year 2020, stand some 70 to 75 cm higher than now. (Author)
W86-03862

EFFECTS OF COASTAL STRUCTURES ON SHORELINE STABILIZATION AND LAND LOSS - THE TEXAS EXPERIENCE,
Texas Univ. at Austin. Bureau of Economic Geology.
R. A. Morton.
IN: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, October 5-7, 1981, Baton Rouge, Louisiana. FWS/OBS-82/59, September 1982. p 177-186, 6 fig, 7 ref.

Descriptors: *Wetlands, *Beach erosion, *Coastal structures, Barrier islands, *Texas, Erosion, Marshes, Coastal marshes, Environmental effects, Resource management.

Recent studies indicate that Texas is losing about 120 ha (300 acres) of wetlands and 40 ha (100 acres) of gulf-front property annually. Although total land losses in Texas are considerably less than those in Louisiana, they are still substantial and the reason many shoreline protection structures have been erected. The structures have not always produced the desired effects, however. Instead, some have accelerated erosion of nearby beaches. Groins have generally been ineffective because sand supply is inadequate where beaches are eroding. With one exception, seawalls built on Gulf of Mexico beaches have failed or have been severely damaged during storms. Most bulkheads and seawalls have protected the adjacent property, but at the expense of publicly-owned recreational beaches that are eroded by the reflected wave energy. Because of similarities in geologic setting and physical processes along the gulf coast, the effects of these structures can be evaluated and the results applied to Louisiana where shoreline stabilization is being considered to mitigate land loss. (Author)
W86-03863

COMPARISON OF EFFECTIVENESS OF MANAGEMENT OPTIONS FOR WETLAND LOSS IN THE COASTAL ZONE OF LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
J. W. Day, and N. J. Craig.
IN: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, October 5-7, 1981, Baton Rouge, Louisiana. FWS/OBS-82/59, September 1982. p 232-239, 1 fig, 1 tab, 22 ref.

Descriptors: *Wetlands, *Management planning, *Louisiana, *Resources management, Resources development, Canals, Dredging, *Atchafalaya River.

The effectiveness of three management options for the control of wetland loss in the coastal zone of Louisiana is discussed. These wetlands are currently experiencing an overall net loss of approximately 130 sq km/yr. Various management options have been suggested to combat the problems, including management of the current land building of the Atchafalaya River; controlled diversion schemes on the lower Mississippi River; and strict regulatory control of canals within the coastal zone. Studies of these options reveal that regulatory control of new canals could reduce the loss rates approximately 30 to 40 sq km/yr, in contrast to 1 to 3 sq km/yr for controlled diversion plans, and approximately 18 sq km/yr for land building by the Atchafalaya River. (Halterman-PTT)
W86-03866

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

PREPARATION OF ION-EXCHANGE MEMBRANES WITH EXTREMELY LOW AREAL RESISTANCES,
Southern Research Inst., Birmingham, AL.
Project 4361, Report 6, Final Report to Bureau of Reclamation, Washington, DC. Office of Water Research. 63 p, 7 fig, 9 tab, 2 app. 4361. 14-34-0001-9411.

Descriptors: *Desalination apparatus, *Ion-exchange, *Membranes, *Areal resistance, Cation exchange, Resins, *Semipermeable membranes.

This is the final report on a research program whose primary objective was the evaluation of the service lifetimes of ion-exchange membranes developed under a previous contract. These membranes have extremely low areal resistances and appeared to be advantageous for seawater desalination. The approach used was to reinforce ion-exchange polymers that were known to be low in resistance but were too weak and dimensionally unstable for use. To evaluate the service lifetimes, properties of the experimental membranes were compared with commercial membranes produced by two manufacturers (Tokuyama Soda, Inc., and Ionac Chemical Co.). All of these membranes were used simultaneously in an electrodialysis stack to desalt a sodium chloride solution that simulated seawater (0.6 N NaCl). Findings indicated that the experimental low-resistance cation-exchange membranes

retained their low resistances and high transference numbers better than both the Ionac membranes and the Tokuyama control membranes. Since the experimental cation-exchange membranes had much lower resistances than the Tokuyama membranes (1.2 ohm-sq cm compared with 2.5 ohm-sq cm), these new membranes appear to warrant further development. In the first lifetime evaluation, the experimental anion-exchange membranes lost their physical strength. The loss of strength was determined to be caused by hydrolysis of the polyester nonwoven reinforcing fabric. This hydrolysis was catalyzed by the amines of the anion-exchange resin. Studies were then focused on the stabilities toward amine-catalyzed hydrolysis of a wide selection of nonwoven fabrices with suitable thicknesses and void volumes. Polypropylene fabrics were the most stable, but the ion-exchange polymer would not adhere well to the polypropylene. Nylon 6-6 fabrics also appeared to be stable, and good pinhole-free membranes were made with these fabrics. However, these improved anion-exchange membranes also degraded in strength during 1000 hours of service. It was concluded that it is improbable that good anion-exchange membranes with acceptable lifetimes can be developed by reinforcing low-resistance ion-exchange polymer with currently available nonwoven fabrics.
W86-03615

IMPROVED SURCHARGE COMPUTATION, IN EXTRAN,
Camp, Dresser and McKee, Inc., Annandale, VA.
J. A. Aldrich, and L. A. Roesner.
In: Proceedings of Stormwater and Water Quality Management Modeling Users Group Meeting, March 25-26, 1982, Washington, DC. EPA-600/9-82-015, August 1982. p 179-190, 4 fig, 3 ref.

Descriptors: *Storm runoff, *Urban hydrology, *Mathematical models, *Computer programs, *Computer models, *EXTRAN, Pressure flow, Storm water, Navier-Stokes equation.

The Extended Transport Block of the Stormwater Management Model (EXTRAN) is one of a few models able to dynamically route gradually varied flow through urban drainage systems. This is accomplished by explicitly solving the full Navier-Stokes equation for a wide variety of hydraulic conditions. This paper describes the need for, and the operation of, a modification to the surcharge computation routine via a surcharge iteration loop. The loop dramatically improves the accuracy of EXTRAN under severe surcharge conditions, while using less computer time. Balancing the fraction of the average surcharge flow and the maximum number of iterations for accuracy and computer time, is problem-dependent and requires a certain amount of user experience.
W86-03832

3B. Water Yield Improvement

INVESTIGATION OF THE FEASIBILITY OF SECONDARY RECOVERY OF GROUND WATER FROM THE OGALLALA AQUIFER: A REPORT TO THE SIXTY-EIGHTH LEGISLATURE.
Texas Dept. of Water Resources, Austin.
LP-185, November 1982. 58 p, 11 fig, 5 ref.

Descriptors: *Feasibility studies, *Secondary recovery, *Water yield improvement, *Groundwater, *Aquifer characteristics, *Aquifers, Capillary capacity, Capillary water, Mathematical models, Aeration zone, Economic feasibility.

The Texas Legislature directed the Department of Water Resources to investigate the feasibility of secondary recovery of ground water from the Ogallala aquifer. It appears that injection of air into the unsaturated zone of the aquifer offers, in some locations, exciting possibilities of increasing the volume of water recoverable from the aquifer by conventional well pumping. The reason for the extra water is not understood. The cost of such recovery probably is economically feasible only for municipalities whose existing water supply is almost exhausted. Sites with a saturated clay layer overlying the injection zone appear to offer good prospects of secondary recovery by air injection. Test hole drilling and core analysis showed that the moisture content for material between the bottom of the root zone (about 10 ft below land surface) and the 1980 water table ranged from 10-40% by volume with an average of about 25%. Using the average value, the 3.35 billion acre-ft of currently unsaturated material in the Ogallala Formation would contain about 840 million acre-ft of capillary water. A literature review identified five potential secondary recovery techniques: air drive, surfactant/foam, thermal, vibration, and electro-osmosis. Laboratory tests showed that applying 2 pounds per square inch air-drive pressure resulted in a 20% increase in water yield over that obtainable by gravity drainage alone. (Fazio-Omniplan)
W86-03442

SCPP FORECASTING SUPPORT FOR THE PERIOD 1 DECEMBER 1978 THROUGH 30 SEPTEMBER 1984,
Electronic Techniques, Inc., Fort Collins, CO.
Bureau of Reclamation, Washington, DC. October 1984. 294 p, 69 fig, 36 tab, 44 ref, 6 append. 9-07-85-V0021.

Descriptors: Precipitation, *Weather modification, *Cloud seeding, Orographic precipitation, Radar, Rawinsondes, Forecasting, Sierra Cooperative Pilot Project, Colorado, Mountains, Meteorological data collections, Data collections.

A summary of work done for the Sierra Cooperative Pilot Project covers field services, data reduction, and analysis. Tables summarize radar, rawinsonde, and forecasting operations. General support analysis remained relatively consistent over the six years of the contract. Descriptions and examples of Precipitation Echo Types (PET), time-height section variable calculations, and time and space cross sections are provided. Specific analyses performed in support of the project's randomized seeding experiment in convection are summarized: analysis of the PETs by season, weather type and synoptic features; radar and meteorological descriptions of experimental days; detailed analysis of radar data from individual clouds; and definitions of radar response variables. Other analyses apply either to experiments in convection or toward developing a seeding experiment in nonconvective cloud systems. These are summarized as studies of covariates of target area precipitation, targeting seeding effects by modifying the NAWC GUIDE model, and simulation of seeding signals by crystal trajectory calculations using flow model winds. Model winds are compared with aircraft and rawinsonde observations. Weather type occurrences and precipitation for the entire study period are compared to historical averages. (Cassar-PTT)
W86-03495

3C. Use Of Water Of Impaired Quality

TREATMENT OF COMBINED INDUSTRIAL AND DOMESTIC WASTEWATER FOR REUSE IN SOUTH AFRICA,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5D.
W86-03890

3D. Conservation In Domestic and Municipal Use

WATER 2000: CONSERVATION PROGRAM.
New Castle County Water Resources Agency, DE.
Volume IV, A Water Plan for New Castle County, DE. April 1982. 64 p, 7 tab, 17 ref.

Descriptors: *Water conservation, *Delaware, *Public participation, *Administration, *Future planning, *Longterm planning, Management planning, Nonstructural alternatives, Attitudes, Projections, Seasonal depletion, Optimum development plans, Local governments, Jurisdiction.

WATER 2000 is a cooperative planning effort between water suppliers and State and local agencies to achieve and maintain a balance between water resources and water use while minimizing both costs to the public and conflicts with other community goals. The plan is designed to meet the area's needs to the year 2000 and beyond. Per capita water use for public supply has increased 42% since 1954 and 16% since 1974 even with a declining population during 1974-78. At this rate, demand could exceed 200 gallons per capita/day by 2000; however, a drought or peak summer load could put a strain on the system. In looking to the future, three management alternatives have been recommended: demand management, aimed at maximizing the use of existing supplies; facility management to improve extant distribution systems; and resource management to develop new water sources. This paper is most concerned with demand management/increasing public awareness. A threefold information and education program is planned to (1) increase public awareness of the benefits of water conservation; (2) reduce per capita water demand; and (3) minimize the need for additional water sources, storage and treatment facilities. The means to carry out the program include printed material, the news media, personal contact, special events and school programs which will be undertaken by a number of different jurisdictions, agencies and organizations in the public and private sectors. The costs and staff time would be assured by the implementing body. A successful program in New Castle County can serve as a model for other areas. (Atkins-Omniplan)
W86-03445

DROUGHT-RELATED IMPACTS ON MUNICIPAL AND MAJOR SELF-SUPPLIED INDUSTRIAL WATER WITHDRAWALS IN TENNESSEE, (PART A AND PART B),
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 6D.
W86-03560

3E. Conservation In Industry

WATER RECYCLING IN THE PULP AND PAPER INDUSTRY IN CALIFORNIA,
Camp, Dresser and McKee, Inc., San Francisco, CA.
J. T. O'Rourke.
California Water Resources Control Board, Sacramento Office of Water Recycling. January 1982. 188 p, 7 fig, 15 tab, 45 ref, 5 append.

Descriptors: *California, *Recycling, *Pulp and paper industry, *Water supply, *Water conservation, *Wastewater renovation, *Water reuse, Industrial water, Water use, Economic aspects, Legal aspects, Municipal wastewater, Effluents, Mills, Water quality, Pricing.

The pulp and paper industry in california is the second largest industrial user of freshwater, using approximately 56 billion gallons per year and, as such, is a primary candidate for water conservation by recycling or by wastewater reclamation and reuse. The Office of Water Recycling wanted to determine if the pulp and paper industry presents a potentially significant, easily identifiable opportunity for water conservation by water and wastewater reuse. The report examines the economic, political, and technical aspects of implementing reuse. The most widely practiced method of conservation continues to be in-plant reuse, the primary reasons being economic and legal/institutional: i.e., the practice reduces costs to the mill operator both for water purchase and wastewater treatment, to the mill operator; and the practice is totally controllable by the operator. The gap between existing and potential reuse is not caused by lack of technical knowhow, but by economic and institutional conditions at individual facilities. Techniques employed during the study were a literature review, statistical data collection, and detailed review of several existing projects, including site visits. The single economic/legal/institutional change with the most impact would be the elimination or significant alteration of the antipar-

alleling statutes. The most direct economic impact would be made by grant-funding programs of water conservation in the pulp and paper industry. (Fazio-Omniplan)
W86-03437

CHEMISTRY IN WATER REUSE: VOLUME 1,
For primary bibliographic entry see Field 5D.
W86-03520

EVALUATION OF THE PUBLISHED LITERATURE IN THE WATER REUSE/RECYCLE AREA,
Versar, Inc., Springfield, VA.
E. F. Rissmann, and E. F. Abrams.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 1-14, 3 fig, 2 tab, 28 ref.

Descriptors: *Water conservation, *Water reuse, *Literature review, *Recycling, Conservation, Industrial wastewater, Wastewater renovation, Pulp and paper industry, Metal-finishing wastes, Inorganic chemicals, Oil refineries, Steel industry, Food processing industry.

A literature search on water reuse disclosed over 2000 references, including 73 discrete case histories. Most case histories applied to six industrial categories: pulp and paper, electroplating, inorganic chemicals, petroleum refining, iron and steel, and food products. Most work involved the removal of inorganic contaminants from wastewater. The few references to organics removal concerned acetates and phenolic-type materials. Problems in recycle technology include the buildup of dissolved salts and disposal of large volumes of waste solids such as gypsum, red muds, and ore residues. Future growth in water reuse is expected to occur in the industries already using this technology.
W86-03521

CONTROL AND MEASUREMENT OF ORGANIC MICROPOLLUTANTS IN SOUTH AFRICAN WATER RECLAMATION PLANTS,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5A.
W86-03522

GROSS ORGANICS MEASUREMENTS FOR MONITORING OF WASTEWATER TREATMENT AND REUSE,
TAHAL-Water Planning for Israel Ltd., Tel-Aviv.
For primary bibliographic entry see Field 5A.
W86-03523

HYPERFILTRATION OF TEXTILE PROCESS WATER FOR REUSE,
Clemson Univ., SC.
For primary bibliographic entry see Field 5D.
W86-03535

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

PROCEEDINGS OF WORKSHOP ON ALGAL MANAGEMENT AND CONTROL,
Environmental Monitoring Systems Lab., Las Vegas, NV.
March 9-12, 1980, Pacific Grove, CA. Technical Report E-81-7, May 1981. Final Report. Army Engineer Waterways Experiment Station, Vicksburg, MS. 313 p. Interagency No. EPA-IAG-78-R-X0383.

Descriptors: *Biocontrol, *Algal control, *Algicides, *Conferences, *Water quality management, Biological properties, Algae, Algal toxins, Eutrophication, Water management, Aeration, Zooplankton.

A workshop was held 9-12 March 1980 in Pacific Grove, California to review state-of-the-art techniques for the management and control of lacustrine algal populations, to establish the functional availability and limits of various algal management and control techniques, and to determine research needs in relation to the further development of algal management and control techniques. The workshop consisted of formal reviews of approaches or perspectives to be considered in the management and control of algal populations; plenary discussions; and formal panel deliberations. The topics discussed included: control measures for objectional algal blooms, selective algicides, state-of-the-art summary of phosphorus inactivation as a lake restoration technique, aeration circulation for control of algal production, control of non-point nutrient caused algal problems especially by dilution, limits to the control of algal populations by grazing zooplankton, algal control through trophic-level interactions, extracellular metabolite involvement in plankton community structure, cyanophages as potential biological control agents of nuisance blue-green algae, and the utilization of bacteria in managing cyanobacterial populations. A bibliography of algicides and algal management and control topics is also given. (Geiger-PTT)
W86-03483

STREAMFLOW AUGMENTATION AT FOSTERS BROOK, LONG ISLAND, NEW YORK - A HYDRAULIC FEASIBILITY STUDY,
Geological Survey, Syosset, NY. Water Resources Div.
K. R. Prince.
Available from Dist. Br., 604 So. Pickett St., Alexandria, VA 22304. USGS Water Supply Paper 2208, 1984. 43 p, 17 fig, 5 tab, 14 ref.

Descriptors: *Surface-groundwater relationships, Surface waters, *Flow augmentation, *Streamflow, Unsaturated flow, *Infiltration, *Seepage, Nassau County, Long Island, Fosters Brook, *New York, Hydraulic feasibility studies.

A 27-day streamflow-augmentation test was conducted in December 1979 at Fosters Brook, near the south of Long Island, to investigate the hydraulic feasibility of pumping ground water to supply flow to an ephemeral stream during dry periods. Measurements of soil moisture in the unsaturated zone beneath the streambed indicate that infiltration rate and soil-moisture content are interrelated. Soil moisture in the unsaturated zone ranged from 20 percent at the start of the test to 41 percent, nearly the saturation point, 20 days later. During the first 24 hours of the test, the stream reached a maximum length of 2,050 feet but, after 13 days, had decreased to 1,300 feet as a result of seepage losses. The relationship between discharge and stream length was linear within the range of discharges investigated (0.54 to 1.63 cubic feet per second). (USGS)
W86-03551

FINAL ENVIRONMENTAL IMPACT STATEMENT: REGIONAL FLOOD CONTROL TONAWANDA CREEK, GENESEE COUNTY, NEW YORK,
Corps of Engineers, Buffalo, NY. Buffalo District.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-120213, Price codes: A20in paper copy, A01 in microfiche. November 1981. 453 p, 10 plates, 14 append.

Descriptors: *Flood cotrol, *Reservoirs, *Protection, *Wildlife, *Environmental effects, *Stream improvement, Batavia, New York, Tonawanda Creek, Dams, Flood protection, Flood-control storage, Storage, Storm runoff, Construction, Dam effects, Detention reservoirs, Earth dams, Fish, Aquatic habitats, Channel improvement, Economic impact, Wetlands, Habitats, Invertebrates, Benthos, Social impact.

The Batavia Reservoir Compound modified alternative plan is recommended for reducing flood damage in the Tonawanda Creek Watershed, New York. The $25.8 million project consists of two shallow, normally dry detention reservoirs arranged in series. Each of the two earthen dams would have a principal and emergency spillway and a reservoir. The main channel of the connecting creek would be cleared of snags and debris to provide a channel cpacity of 2000 cu ft per sec. The reservoirs are designed to detain a 500-year flood 2-8 days longer than under existing conditions. This would reduce annual flood damages by 74%. Average annual benefits are $3.3 million. Construction of embankments and dikes requires clearing and stripping of 126 acres in addition to filling 44 acres of wetlands, eliminating some food and cover used by wildlife. Channel clearance would cause temporary silting of the stream and destroy some aquatic habitat.
W86-03626

SAND DUNE VEGETATION AND STABILIZATION IN LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 2J.
W86-03864

COMPARISON OF EFFECTIVENESS OF MANAGEMENT OPTIONS FOR WETLAND LOSS IN THE COASTAL ZONE OF LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 2L.
W86-03866

4B. Groundwater Management

GROUND WATER IN CARBONATE ROCKS AND REGOLITH IN THE FAIRVIEW AREA, TENNESSEE,
Geological Survey, Nashville, TN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03548

ARTIFICIAL RECHARGE OF GROUNDWATER RESOURCES IN SEMIARID REGIONS,
Maiduguri Univ. (Nigeria). Dept. of Agricultural Engineering.
O. B. Jacenkow.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 111-119, 8 fig, 2 tab, 6 ref.

Descriptors: *Recharge, *Groundwater recharge, *Water storage, *Groundwater management, *Water management, *Geohydrology, Artificial recharge, Groundwater storage, Hydrology, Arid lands, Semiarid lands, Wells, Cavity wells, Borno, Nigeria, Excess rainfall, Rainfall, Precipitation, Evaporation.

Storage of rain water in confined aquifers was investigated in the semiarid Borno State, Nigeria. In this region 70% of the yearly average precipitation (380 mm in the south to 1029 mm in the north) falls in July, August, and September. Potential evaporation is 1907.1 mm per year. Well levels have been falling steadily since 1979. Rainfall exceeds evaporation during July and August, with a 152.4 mm excess. Interception of only 1% of this excess would provide an additional 90 million cu m of water, about the same as the present yearly abstraction. To minmize clogging during aquifer recharge, cavity wells are suggested. Instead of a filter screen, the cavity well has a cavern formed in the permeable layer by intense pumping. These wells are effective as recharge or discharge wells and may be unclogged by pumping.
W86-03572

OPTIMIZATION OF CONJUNCTIVE USE OF GROUNDWATER AND SURFACE WATER RESOURCES IN THE VAAL BASIN,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Civil Engineering.
W. A. J. Paling.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium,

July 1984. IAHS Publication No. 144, 1984. p 121-128, 5 fig, 4 ref.

Descriptors: *Recharge, *Groundwater recharge, *Conjunctive use, *Wastewater disposal, *Water storage, *Groundwater management, *Water management, *Geohydrology, Artificial recharge, Vaal River, Johannesburg, South Africa, Rivers, Reservoirs, Water supply.

A scheme for supplementing water supplies from the Vaal River, South Africa, with groundwater involves recharge with secondary sewage effluent. This river, which is a water supply for 6 million persons in the Johannesburg area, has a highly irregular flow. A barrage and a reservoir allow a sustained yield of 37.7 cu m per sec. The Suurbekom compartment of the aquifer is most suitable for recharging, since it is not involved in gold mining and does not underlie a population center. It is proposed to transport secondary effluent to this compartment at 3 cu m per sec. Maximum net storage of the dam is 2200 million cu m; maximum reliable draft, 37.7 cu m per sec. Assuming the maximum groundwater abstraction rate to be 5.71 cu m per sec and with unlimited groundwater resources, the sustained conjunctive yield could be increased to 43.38 cu m per sec, an improvement of 15%. Accepting the limitation of an underground reservoir of 250 million cu m storage and a replenishment of 3 cu m per sec of effluent, conjunctive drawoff would be 42.24 cu m per sec, an improvement of 12%.
W86-03573

MEASUREMENT OF SOIL LOSS FROM EXPERIMENTAL BASINS IN MALAWI,
Hydraulics Research Station, Wallingford (England).
For primary bibliographic entry see Field 2J.
W86-03590

4C. Effects On Water Of Man's Non-Water Activities

GEOCHEMISTRY AND GEOHYDROLOGY OF THE WEST DECKER AND BIG SKY COAL-MINING AREAS, SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2K.
W86-03545

HYDROLOGY OF AREA 1, EASTERN COAL PROVINCE, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03547

WATER RESOURCE DATA AND TREND ANALYSIS FOR THE BLUE CREEK WATERSHED PROJECT, PIKE COUNTY, ILLINOIS: PHASE II,
Illinois State Environmental Protection Agency, Springfield. Div. of Water Pollution Control.
For primary bibliographic entry see Field 5G.
W86-03610

IMPACTS OF FLOODING REGIME MODIFICATION ON WILDLIFE HABITATS OF BOTTOMLAND HARDWOOD FORESTS IN THE LOWER MISSISSIPPI VALLEY,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 6G.
W86-03634

4D. Watershed Protection

VELD BURNING AND SEDIMENT YIELD FROM SMALL DRAINAGE BASINS,
Durban-Westville Univ. (South Africa). Dept. of Geography.
H. K. Watson.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 323-333, 1 fig, 9 tab, 9 ref.

Descriptors: *Erosion control, *Sediment yield, *Vegetation, *Rainfall-runoff relationships, *Soil conservation, Conservation, Soil erosion, Firebreaks, Stream discharge, Runoff, Organic matter, Natal Drakensberg, Mountain watersheds, Watershed management.

The following parameters were monitored in two adjacent and physiographically comparable drainage basins in the Natal Drakensberg: rainfall, vegetation cover, stream discharge, sediment yield and the organic and dissolved solids components of the total stream load. An original splitting system design was employed to obtain measurements of the stream load components. Both drainage basins were monitored for a period prior to the application of an autumn burn treatment to one of them, and for a full annual cycle after the treatment. A significant reduction in the rate of subsurface water movement and in the baseflow discharge volume may be attributed to the firebreak treatment. The treatment did not appear to have any substantial effect on storm runoff, nor on the sediment, organic and dissolved solids of the stream load components. (Author)
W86-03588

GULLY EROSION IN THE AGULU-NANKA REGION OF ANAMBRA STATE, NIGERIA,
Anambra State Univ. of Technology, Awka (Nigeria). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2J.
W86-03589

SEDIMENT YIELD ESTIMATION AND THE DESIGN OF SEDIMENT CONTROL STRUCTURES IN RURAL AFRICA,
Steffen, Robertson and Kirsten, Inc., Johannesburg (South Africa).
A. Ward, and B. Middleton.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 415-425, 35 ref.

Descriptors: *Erosion, *Erosion control, *Sediment control, *Sediment yield, *Model studies, *Environmental effects, Computer models, SEDIMOT-II model, Africa, Design criteria, Vegetation, Agriculture, Urbanization, Mining, Runoff, Rainfall-runoff relationships, Soil loss, Rural areas.

A computer-based technique, SEDIMOT-II, is a single event distributed parameter model which simulates runoff, erosion, and sediment transport on a disturbed basin. Hydrographs and sedimentgraphs are prepared for individual sub-basins. Then these flows are routed to sediment control structures to evaluate the sediment trap efficiency of the controls. Sediment control options include check dams, sediment dams, and vegetative filters. Evaluation of sedimentation problems involves development of preventive measures, design of control measures, impact assessments, and design of remedial measures. Preventive measures well suited to rural areas are drainage control, terracing, tillage practices, and mulching. Some impacts which may be assessed include irrigation schemes, agricultural development, silviculture, mining, industrial or urban development, construction of weirs and dams, and upstream impacts on existing hydraulic structures. Remedial measures most often required in rural areas are weir and impoundment desilting, gully reclamation, and dirt road maintenance.
W86-03595

SHEET EROSION FROM ARABLE LANDS IN ZIMBABWE: PREDICTION AND CONTROL,
Institute of Agricultural Engineering, Harare (Zimbabwe).
For primary bibliographic entry see Field 2J.
W86-03596

MULCH REQUIREMENTS FOR EROSION CONTROL WITH THE NO-TILL SYSTEM IN THE TROPICS: A REVIEW,
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
R. Lal.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No 144, 1984. p 475-484, 3 fig, 4 tab, 28 ref.

Descriptors: *Erosion control, *Soil conservation, *Agriculture, *Mulching, *Cover crops, *Vegetation, *Cultivation, No-till, Tropical regions, Terracing, Soil erosion, Runoff, Slopes, Africa, Farming.

Mulch farming and no-till systems have proved suitable for reducing runoff and soil erosion to within tolerable limits in West Africa. Graded channel terracing as practiced in Africa is ineffective at slope gradients exceeding 5%. Intense storms with return periods of 5-10 years cause enormous damage to the arable lands and structures. Mulching has been successfully used to prevent excessive soil erosion in tea plantations and pineapple plots. Mulching reduced runoff by 11-35 times and erosion by 188-750 times, depending on slope. However, mulch rates of 4-6 t per ha are difficult to procure. Some creeping and low growing legumes recommended as cover crops on steep lands are Mucuna utilis, Panicum colaratum, Psophocarpus palustris, and Stizolobium deeringianum. No-tillage reduces runoff by 70-90% and soil erosion by 97% when compared with conventional plowing. No-till is not an effective erosion control measure unless 2-4 t per ha per crop of mulch is also applied.
W86-03600

RUNOFF, EROSION AND SOIL FERTILITY RESTORATION ON THE MOSSI PLATEAU (CENTRAL UPPER VOLTA),
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
E. Roose, and J. Piot.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No 144, 1984. p 485-498, 1 fig, 4 tab, 20 ref.

Descriptors: *Erosion control, *Soil conservation, *Cultivation, *Soil loss, *Rainfall-runoff relationships, Sediment transport, Runoff, Agricultural engineering, Mossi Plateau, Upper Volta, Deserts, Arid lands, Sudan, Sheet erosion, Fallowing, Cropland, Vegetation, Conservation, Land use.

Field studies of erosion on the Mossi plateau, central Upper Volta, indicated that traditional methods (numerous low filtering structures and restoration of soil fertility) are the most suitable strategies for stopping desertification at the Sahel border. At the four sites in the study area rainfall variability and intensities are high, the ferruginous soils or vertisols have low permeabilities, and the vegetation cover is poor as a result of overgrazing, bush fires, and extensive cultivation. Runoff on four study plots was 20-40% per year on overgrazed and extensively cultivated lands. Runoff reached 70% during heavy showers. Soil losses were considerable even at the <2% slope. Fine particles, organic matter, and nutrients were selectively carried away, leaving a sandy or gravelly skeleton unable to retain water and nutrients. Soil losses were more dependent on the amount of vegetative cover and the roughness of the soil surface than on the soil type or cultivation practices. Compared with bare soil, erosion is reduced to 40% under millet, maize, and sorghum; to 30% under peanut; to 20% under creeping niebe; to 1-4% under young fallow or Congo pea; to 5% under burnt savanna; and to <1% under protected savanna.
W86-03601

SURFACE EROSION AND SEDIMENT CONTROL AT OPEN-CAST MINES IN SOUTHERN AFRICA,
Steffen, Robertson and Kirsten, Inc., Johannesburg (South Africa).

A. Ward, A. Smith, and J. Caldwell.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No 144, 1984. p 517-527, 2 fig, 3 tab, 14 ref.

Descriptors: *Erosion control, *Sediment control, *Coal mining, *Sediment yield, *Soil loss, *Soil conservation, Soil stabilization, Conservation, Sedimentation, Runoff, Rainfall-runoff relationships, Drainage systems, South Africa.

Severe erosion from surface mining of coal occurs in the following locations: topsoil stockpiles, spoil piles, waste dumps, bare topsoil areas, steep outslopes, ramps, and haul roads. Many sediment control techniques are available. Surface stabilization reduces erosion until a vegetative cover can be established. Methods of achieving this include mulches and chemical stabilizers (expensive and temporary), and matting and netting (good for steep slopes). Landscaping activities should be done with agricultural equipment rather than heavy mining equipment. Drainage control is very important in reducing the volume and velocity of flows crossing disturbed areas and to prevent mixing of clean and dirty flows. Clean systems divert water from undisturbed areas away from disturbed areas; dirty systems collect water from disturbed areas and convey it to treatment facilities. Sediment can be removed from a flow by gravity settling, cyclones, check dams, vegetative filters (grass and reeds), barriers and fences (hay bales, etc.), and filter fabric fences (semipermeable fabrics). Removing colloidal particles from sediment requires sediment ponds or chemical flocculation. The methodology described has been applied to a proposed South African mine site. Calculations show that, without careful management and sediment control, severe erosion would occur. For this particular site, diversion ditches, terracing, and sediment ponds are suggested.
W86-03602

INDIGENOUS SOIL CONSERVATION STUDIES IN SIERRA LEONE,
Reading Univ. (England). Dept. of Geography.
A. C. Millington.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No 144, 1984. p 529-538, 5 tab, 15 ref.

Descriptors: *Erosion control, *Soil conservation, *Agriculture, Sierra Leone, *Soil loss, Conservation, Slopes, Drainage, Bunding, Cultivation, Sheet erosion, Mulching, Cover crops, Terracing, Sediment control.

The indigenous soil conservation practices in Sierra Leone were surveyed. The 44 categories of conservation strategies were divided into mechanical (impedance of sheet flow, site selection, modification of the cultivation system) and biological (adjustment of cultivation techniques such as timing of different tasks, mulching, and cover cropping). Use of a single conservation method was most common (61.18%). Five levels of sophistication were described, each using more complicated combinations of individual methods. Bunding with sticks and/or stones was the most commonly used technique. Slightly less favored were, in descending order, drainage of excess surface water, mulching and cover cropping. Experiments on bunding techniques showed that the sticks or stones used in construction are commonly available. Labor required for bunding techniques was on the order of 15-30 man hours to build a 100 m length compared with 808 man hours to construct 100 m of bench terracing. Soil losses were 4.40-29.49 t per ha per year, contour bunding being most effective. Using no conservation technique, soil losses were up to 55.1 t per ha per year.
W86-03603

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

STUDIES ON ANALYTICAL METHOD OF ACRYLAMIDE MONOMER AND ACCUMULATION INTO FISH,
Tsukuba Univ. (Japan). Inst. of Community Medicine.
For primary bibliographic entry see Field 5B.
W86-03466

ANALYSIS OF CHLORINATED ORGANIC COMPOUNDS FORMED DURING CHLORINATION OF WASTEWATER PRODUCTS,
North Texas State Univ., Denton.
W. H. Glaze, J. L. Burleson, J. E. Henderson, P. C. Jones, and W. Kinstley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-144444, Price codes: A09 in paper copy, A01 in microfiche. EPA-600/4-82-072, December 1982. 180 p, 40 fig, 34 tab, 169 ref, 2 append.

Descriptors: *Wastewater analysis, *Wastewater composition, *Chlorinated hydrocarbons, Chlorination, Wastewater treatment, Water treatment, Gas chromatography, Chromatography, Mass spectrometry, Hydrocarbons.

Chemical byproducts produced during the chlorination of municipal wastewater were examined in a study that employed several specially modified analytical methodologies. Volatile byproducts were examined by the use of gas chromatography with selective detectors and gas chromatography/mass spectrometry (GC/MS). Using XAD resins for concentration of trace organics in the wastewater samples before and after chlorination, a number of chlorinated aromatic and aliphatic compounds were found after chlorination and superchlorination. A rapid and convenient microextraction method was developed that is suitable for the analysis of trihalomethanes and other volatile halogenated organics at the microgram/l level in water. Also, a computer program was developed that may be used in conjunction with a GC/MS computertized data system for thee identification of polyhalogenated compounds present as minor components in a complex chemical mixture. A procedure also was developed to determine the concentrations of amino acids in wastewaters, sludges and septage, before and after chlorination. Two chlorinated derivatives of tyrosine were found in a superchlorinated septage sample. Nonvolatile compounds in natural waters and municipal wastewaters, before and after chlorination, were studied by high performance liquid chromatography. Fractions collected before chlorination of the sample showed that trihalomethane formation potential was spread throughout the natural polymer. (Author)
W86-03496

DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN INDUSTRIAL DISCHARGES AND OTHER AQUEOUS EFFLUENTS,
Norsk Inst. for Vannforskning, Oslo.
L. Berglind.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-135608. Price codes: A02 in paper copy, A01 in microfiche. Nordic PAH Project Report No 16, January 1982. 18 p, 5 tab, 11 ref.

Descriptors: *Polycyclic aromatic hydrocarbons, *Aromatic compounds, *Drinking water, *Surface water, *Water pollution sources, Hydrocarbons, Pollutant identification, Water analysis, Wastewater analysis, Industrial wastes, Carcinogens, Wastewater, Industrial wastewater, Runoff, Effluents, Precipitation.

As a part of an inter-Nordic research program on polycyclic aromatic hydrocarbons (PAH) in the environment, different sources of PAH to Norwegian waters have been investigated. Some samples of surface water and drinking water have also been analyzed. PAH concentrations in an aluminum smelter daily discharge were estimated to be 73 kg of which 6.5 kg are carcinogenic. In a ferro alloy smelter, the PAH concentrations in the daily discharge were 9.7 kg of which about 0.9 kg are carcinogenic. The PAH concentration in the daily discharge of an ironworks was estimated to be 93.4 kg of which 19.2 kg are carcinogenic. The total PAH discharge from the coke works to the Ranafjord was estimated to be about 23 kg/day of which 0.4 kg are carcinogenic. The discharge of PAH from an oil refinery was estimated to be 0.26 kg/day of which 0.002 kg are carcinogenic compounds. PAH concentrations in runoff from a Norwegian highway ranged from 1772-11604 ng/1. PAH concentrations in various surface water and drinking water samples are also given. (Geiger-PTT)
W86-03506

REPORT OF ANALYSES FOR LIGHT HYDROCARBONS IN GROUND WATER,
Du Pont de Nemours (E.I.) and Co., Aiken, SC. Savannah River Plant.
E. L. Dromgoole.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-017300, Price codes: A02 in paper copy, A01 in microfiche. DPST-81-141-19, April 1982. 14 p, 3 fig, 2 tab, 110 ref. DE-AC09-76SR00001.

Descriptors: *Groundwater, *Water quality, *Groundwater pollution, Water pollution, Hydrocarbons, Chemical analysis, Water analysis, Chemical composition, United States, Gas chromatography.

The analyses of 11,659 groundwater samples, collected in 47 western states as part of the National Uranium Resource Evaluation hydrogeochemical and stream sediment reconnaissance program, are described. The analytical techniques, for determination of methane, ethane, propane and butane, along with the descriptive statistics used, are briefly described. The coverage maps and sampling site locations are provided. The data are supplied separately on microfiche along with an explanation of the data codes. (Halterman-PTT)
W86-03512

CONTROL AND MEASUREMENT OF ORGANIC MICROPOLLUTANTS IN SOUTH AFRICAN WATER RECLAMATION PLANTS,
National Inst. for Water Research, Pretoria (South Africa).
J. F. van Rensburg, A. J. Hassett, and S. J. Theron.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 17-34, 6 fig, 5 tab, 35 ref.

Descriptors: *Pollutant identification, *Water conservation, *Water reuse, *Water analysis, *Activated carbon, Conservation, Industrial wastewater, Chromatography, Wastewater renovation, *South Africa, Adsorption, Organic compounds, Water treatment, Recycling.

Several analytical techniques have been evaluated for the determination of organic micropollutants in South African water reclamation plants. An organic pollution index (OPI) was used to express data. In this way water samples were divided into safe and possibly unsafe categories. This allowed the safe samples to be analyzed with less expensive methods than required for the possible unsafe samples. The OPI was suggested as an early warning against pending breakthrough in granular activated carbon treatment systems. The reclamation plants investigated were capable of effectively removing organic industrial and other pollutants in shock-load quantities.
W86-03522

GROSS ORGANICS MEASUREMENTS FOR MONITORING OF WASTEWATER TREATMENT AND REUSE,
TAHAL-Water Planning for Israel Ltd., Tel-Aviv.
M. Michail, and E. Idelovitch.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 35-64, 9 fig, 6 tab, 36 ref.

Descriptors: *Pollutant identification, *Water conservation, *Wastewater analysis, *Water analysis, *Monitoring, Water reuse, Water treatment, Ultraviolet absorbance, Wastewater treatment, Organic carbon, Tel Aviv, *Israel, Biochemical oxygen demand, Chemical oxygen demand, Potassium permanganate, Oxygen demand, Chemical analysis.

Nine types of water from the Dan region sewage reclamation project at Tel Aviv, Israel, were analyzed using six gross organic parameters: BOD, COD, total organic carbon, dissolved organic carbon, potassium permanganate consumption, and ultraviolet (UV) absorbance at 254 nm. The water samples included raw wastewater, secondary effluent, tertiary effluent, reclaimed water, and tap water. Good to very high correlation coefficients were obtained for most parameters. Results indicated that UV absorbance was suitable for routine monitoring of gross organics in wastewater treatment and reuse. UV is particularly useful for monitoring of organic matter in municipal raw wastewater feeding the treatment plant, for detection of organic-laden industrial wastes, for monitoring of activated sludge plant performance with respect to carbonaceous matter, for monitoring of the organic quality of reclaimed water, for tracing effluent movement in aquifers, and for monitoring of advanced wastewater treatment plant performance with respect to organics. When using UV absorbance to measure gross organics, it was suggested that good correlations be established for each type of water.
W86-03523

DETERMINATION OF CARBOHYDRATES AND PRIMARY AMINES IN RIVER WATER,
Minnesota Univ., Minneapolis. Dept. of Chemistry.
L. E. Conroy, W. J. Maier, and Y-T. Shih.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 65-84, 8 fig, 6 tab, 19 ref. NSF/ENV 77-04496.

Descriptors: *Fate of pollutants, *Pollutant identification, *Organic carbon, Rivers, Mississippi River, Carbohydrates, Amines, Dissolved solids, Anthrone method, Seasonal variation, Fluorescamine.

For assay of soluble organic species in river water, the anthrone test and the fluorescamine reagent proved most sensitive and reliable for carbohydrates and amines, respectively. Water samples were taken at four locations in the Upper Mississippi River from the headwaters to the Twin Cities area. These sites represented, in order from headwaters to downstream, natural background, agricultural drainage, urban runoff, and a major wastewater discharge. Total soluble carbohydrates increased from 289 micrograms per liter in the headwaters to 792 micrograms per liter at the furthest downstream station. Total primary amine levels were 7-20 times less than carbohydrate levels. The total concentrations of amines were 25.72, 39.68, 33.84, and 32.75 micrograms per liter, progressing downstream. Seasonal variation in percentage of molecular size was noted. This was related to the change in the source of organic matter (groundwater vs. runoff). The distribution of dissolved organic carbon was as follows: the 1K-10K fraction was the largest, the <1K fraction was second in importance, and very little was in the >10K fraction.
W86-03524

ULTRAVIOLET MULTIWAVELENGTH ABSORBANCE MEASUREMENTS FOR MONITORING TRACE ORGANICS IN WATER,
Minnesota Univ., Minneapolis.
W. J. Maier, and L. E. Conroy.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 85-145, 26 fig, 9 tab, 24 ref, 2 append.

Descriptors: *Fate of pollutants, *Pollutant identification, *Organic carbon, *Water analysis, Rivers, Mississippi River, Ultraviolet absorbance, Dissolved solids, Seasonal variation.

Comparison of model compounds identified by absorbance matching shows the same chromophoric units, indicating that the organic constituents of the 1-10K molecular size fractionates of Upper Mississippi River water have similar absorbance characteristics regardless of season or geographical location. Five major model compounds, namely vanillin, 3,4-dimethoxyacetophenone, tannic, p-anisic and mellitic acids (VATAM), and no others, are consistently identified by ultraviolet absorbance matching calculations. None of these compounds are found in the <0.5K fractions. In the 0.5-1K fractions the same five model compounds are present, but at lower concentrations and in different proportions. The similarities in UV spectral and molecular size characteristics of organics in this river stretch with total flow times of 20-30 days and flow variations of 86 to 883 cu m per sec lead to the following hypothesis: (1) VATAM-characterized polymers are formed throughout the whole watershed, (2) the polymers are chemically and biologically relatively stable, (3) they predominate the 1-10K molecular size range, (4) they account for most of the total organic carbon but are less significant in winter, and (5) the presence of a greater diversity of chromophores and a correspondingly smaller concentration of VATAM polymer in winter is ascribed to slower chemical-biological reaction rates.
W86-03525

DEVELOPMENT OF A TOC/COD ANALYZER FOR PROCESS APPLICATIONS,
Life Systems, Inc., Cleveland, OH.
J. B. Lantz, R. J. Davenport, R. A. Wynveen, and W. J. Cooper.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 147-163, 8 fig, 3 tab, 7 ref.

Descriptors: *Pollutant identification, *Monitoring, *Organic carbon, *Water analysis, Wastewater analysis, Chemical oxygen demand, Automation, Measuring instruments.

An analyzer for total organic carbon/chemical oxygen demand has been developed. The analytical package incorporates six processes: electrochemical generation of the persulfate from an acidic electrolyte, continuous sampling and mixing of the sample with the electrolyte and persulfate, removal of inorganic carbon from the sample, oxidation of the organics, measurement of the carbon dioxide produced and persulfate consumed in the oxidation, and elimination of water introduced during sampling. The apparatus is designed to operate over a concentration range of 0.5-500 mg per liter total organic carbon and 100-1500 mg per liter COD. The system has many automatic features for on-line monitoring and interface with computer control systems.
W86-03526

CHEMICAL AND MICROBIOLOGICAL MONITORING OF A SOLE-SOURCE AQUIFER INTENDED FOR ARTIFICIAL RECHARGE, NASSAU COUNTY, NEW YORK,
Geological Survey, Towson, MD. Water Resources Div.
B. G. Katz, and G. E. Mallard.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 165-183, 4 fig, 5 tab, 19 ref.

Descriptors: *Pollutant identification, *Water analysis, *Water pollution sources, Water quality, Recharge, *Artificial recharge, Aquifers, Nassau County, *New York, Groundwater recharge, *Water reuse, Monitoring, Baseline studies, Septic tanks, Cesspools, Organic compounds, Chlorinated hydrocarbons, Bacterial analysis.

The Cedar Creek water reclamation project in Nassau County, New York, was designed to study the feasibility of recharging the groundwater reservoir with reclaimed water. Baseline information on water quality was gathered by sampling in observation wells at depths of 50, 100, and 200 ft below land surface. Preliminary results indicated that groundwater at the recharge site contained elevated concentrations of nitrate, chloride, sulfate, and ammonium ions; however, the concentrations of these ions generally decreased with depth. Chlorinated hydrocarbons (low-molecular weight, pesticides, and polychlorinated biphenyls) were present in significant concentrations in the upper glacial aquifer and Magothy aquifer. Fecal indicator bacteria were found in very few cases in low numbers. Sources of pollution in this area are cesspool and septic tank effluent, domestic cleaners and solvents, fertilizers, insecticides for pest control, and storm water runoff.
W86-03527

QUALITY ASSURANCE FOR WATER AND WASTEWATER ANALYSES,
Environmental Protection Agency, Cincinnati, OH.
J. A. Winter.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 187-205, 2 fig, 5 tab, 6 ref.

Descriptors: *Pollutant identification, *Quality control, *Water analysis, *Wastewater analysis, Water reuse, Chemical analysis, Monitoring.

The EPA quality assurance program for analysis of water and wastewater has the following major functions: develop/select methodology, conduct an equivalency program for approval of alternative test procedures, develop manuals and guidelines, maintain a quality control check sample program, conduct method validation studies, conduct performance evaluation studies, and maintain the EPA repository for toxic and hazardous materials. In the future, laboratories involved in water reuse research and development may be required to participate in quality assurance activities. In preparation for formal involvement in a program, laboratories should take advantage of relevant method validation and performance studies as available and of the wide range of quality control samples in the EPA program for water and wastewater monitoring.
W86-03528

PRIORITY POLLUTANT METHODOLOGY QUALITY ASSURANCE REVIEW,
Environmental Protection Agency, Kansas City, MO. Region VII.
R. D. Kleopfer, J. R. Dias, and B. J. Fairless.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 207-227, 9 tab, 16 ref. 68-01-3857, 4689, and 3852.

Descriptors: *Pollutant identification, *Wastewater analysis, *Organic compounds, *Quality control, Chromatography, Pesticides, Insecticides, Metals, Phenols, Cyanide, Trace levels.

The results of 10,000 measurements by seven laboratories on 104 of the 114 organic priority pollutants, all the metals, and total phenol and cyanide are summarized. The wastewater samples are screened for organics by analyses of five fractions: pesticides (26 compounds), base/neutrals (46 compounds), acids (11 phenols), purgeables (29 volatile organics), and direct aqueous injection (2 compounds). Except for purgeable organics, overall recovery decreases and the relative standard deviation increases in going from the method standard to the matrix spiked analysis. Analysis of purgeable and acid organic compounds produces the highest recoveries with the smallest matrix effect. The analysis of base/neutral compounds and pesticides gives the lowest recoveries because they react among each other and with hydroxide and water. Base/neutral compounds also carry over into the acid fraction in the presence of emulsions. Analysis of purgeable organics by the EPA protocol has

been most successful; acid and pesticide analyses, moderately successful; and base/neutral analysis less successful, especially with samples from the leather tanning and timber industries. Metals analyses are not difficult at the 25 ppb level used. Analyses of several compounds presented problems and are recommended for further investigation: dichloromethane, bis(chloromethyl) ether, N-nitrosodimethylamine, di-n-butylphthalate, bis(2-ethylhexyl) phthalate, 1,2-diphenylhydrazine, benzidine, hexachlorocyclopentadine, endrin aldehyde, anthrene and phenanthrene, chrysene and benzo(a)anthracene, and benzo(b)fluoranthrene and benzo(k)fluoranthrene.
W86-03529

QUALITY ASSURANCE IN THE EVALUATION OF POLLUTION CONTROL TECHNOLOGY: EXPERIENCES AT THE INDUSTRIAL ENVIRONMENTAL RESEARCH LABORATORY, U.S. ENVIRONMENTAL PROTECTION AGENCY, CINCINNATI, OHIO,
Industrial Environmental Research Lab.-Cincinnati, OH.
P. E. Mills.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 229-244, 1 fig, 3 tab, 25 ref.

Descriptors: *Pollutant identification, *Quality control, *Wastewater analysis, *Industrial wastewater, Water conservation, Recycling, Industrial Environmental Research Laboratory, Chemical analysis, Measuring instruments, Monitoring.

The quality assurance program of the Industrial Environmental Research Laboratory (IERL), Environmental Protection Agency, is designed to improve, assure, assess, and document the quality of measurements made and reported in connection with its research. Some of the program's function are to (1) review sampling and analytical plans, (2) approve quality assurance review forms, (3) provide audit samples, (4) approve alternative analytical methods, (5) aid in development of new instruments and methods, (6) conduct audits at field sites and analytical laboratories, and (7) provide quality assurance training. IERL is involved in several projects related to recycle/reuse of industrial wastewater. Research priorities include addition of chemicals to the priority pollutant list, development of better continuous monitoring techniques, selection of representative monitoring parameters, selection of standard reference materials representative of recycle/reuse matrixes, sponsoring of interlaboratory comparisons of new methods and reference materials, and development of testing procedures for sludge.
W86-03530

USE OF LOG-NORMAL STATISTICS IN ENVIRONMENTAL MONITORING,
For primary bibliographic entry see Field 7C.
W86-03531

BIOLOGICAL EVALUATION OF METHODS FOR THE DETERMINATION OF FREE AVAILABLE CHLORINE,
Johns Hopkins Univ., Baltimore, MD. School of Hygiene and Public Health.
M. C. Snead, V. P. Olivieri, and W. H. Dennis.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 401-427, 10 fig, 3 tab, 34 ref.

Descriptors: *Pollutant identification, *Chlorine, *Disinfection, *Water analysis, Residual chlorine, Chloramines, Viruses, Biofac process, Membranes.

All of the methods tested for measurement of free chlorine residuals--N,N-diethyl-p-phenylene diamine (DPD), syringaldazine (FACTS), amperometric titration, and membrane electrode--yield false positive determinations with one or more of the inorganic chloramines. A fundamental understanding of chlorine chemistry and the particular test procedure employed is an absolute necessity. The Steadifac modification of the DPD procedure reduces the frequency and magnitude of false positives obtained. Thioacetamide appears to selectively decolor the product of the DPD-monochloramine reaction. The biological calibration procedure, Biofac, clearly differentiates and quantifies free chlorine, and may have possible extension for other disinfectants. The FACTS procedure was the most specific for free chlorine. Variability of reagent preparations of FACTS limits the quantitative use of this test, in its present form, to the laboratory. Specificity of the DPD reagent was found to vary with the form of the reagent, with the tablet reagent consistently yielding fewer false positives than the powder reagent. The membrane electrode compares favorably with the other procedures for the measurement of free chlorine in the absence of combined chlorine, but was not as specific as DPD and FACTS in the presence of combined chlorine. (Author)
W86-03539

CHLORINE DIOXIDE CHEMISTRY: GENERATION AND RESIDUAL ANALYSIS,
Stanford Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W86-03540

DETERMINATION OF CHLORINE DIOXIDE,
Fischer and Porter, Co., Warminster, PA.
R. G. Stevenson, L. L. Dailey, and B. J. Ratigan.
IN: Chemistry in Water Reuse: Volume I, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 453-476, 11 fig, 58 ref.

Descriptors: *Pollutant identification, *Chlorine dioxide, Residual chlorine, Measuring instruments, Monitoring, Automation, Spectrophotometry, Titrimetric methods, Electrochemistry, Membrane amperometric probe.

Several methods for determination of chlorine dioxide are evaluated for their use in automated or continuous analysis. Direct spectrophotometry at 360 nm is reasonably accurate within the limits of 6-60 mg per liter, provided the cell size is adapted to the concentration. Spectrophotometry with chromagenic reagents is sensitive and accurate but has several drawbacks for continuous monitoring. Titrimetric methods are often used. However, iodine-producing substances interfere with the iodometric method. Several sources of error and possible corrective measures are given. Except for amperometric endpoint detection, electrochemical methods are seldom used for chlorine dioxide determination. Two flow-through amperometric cells seem suitable for continuous electrochemical analysis. The membrane amperometric probe, with no moving parts and no reagent feed, is available for continuous monitoring.
W86-03541

GROUNDWATER QUALITY EVOLUTION IN THE UPPER AQUIFER OF THE COASTAL DUNE AREA OF THE WESTERN NETHERLANDS,
Vrije Univ., Amsterdam (Netherlands). Inst. voor Aardwetenschappen.
For primary bibliographic entry see Field 2F.
W86-03761

ADVANCES IN THE IDENTIFICATION AND ANALYSIS OF ORGANIC POLLUTANTS IN WATER, VOLUME 1.
Ann Arbor Science, Ann Arbor, MI. 1981. Edited by Lawrence H. Keith. 2 v (1170 p).

Descriptors: *Pollutant identification, *Water analysis, *Wastewater analysis, *Organic compounds, *Chromatography, Gas chromatography, Liquid chromatography, Mass spectrometry, Ion exchange, Resins, Master Analytical Scheme, Aromatic compounds, Phenolic compounds, Pesticides, Industrial wastewater, Chlorine compounds, Trihalomethanes, Polychlorinated biphenyls, Tracers, Environmental tracers, Extraction.

Most of the advances in identification and analysis of organic pollutants in water have involved refinements of existing technology. The Master Analytical Scheme is the subject of several papers, divided into an overview, isolation/concentration, precision and accuracy, quantitative aspect, and quality control. A general approach for determination of pesticides in wastewater has been successfully applied to five general classes of compounds. High-resolution gas chromatographic methods have been developed for phenolic compounds; acid-extractable priority pollutants; volatile, base/neutral, and acidic pollutants; and polychlorinated biphenyls. Isotope dilution of organic molecules and tagging with dysprosium compounds are techniques used as environmental tracers. Microextraction techniques are effective and time saving in preparing water samples for organics analysis. This permits chromatography without preconcentration of the sample. Resins are also used to concentrate organic compounds, particularly polyaromatic hydrocarbons, for chromatographic analysis. High-performance liquid chromatography is applied to analysis of nitrophenols, humic-fulvic natural materials, and nitrosamines. Fluroimmunoassay is being developed for determination of very low levels of organic pollutants. Derivatization proved useful in labeling potential mutagens in drinking water with 4-nitrophenol and for determination of linear alcohol ethoxylates.
W86-03791

VALIDATION AND PRIORITY POLLUTANT ANALYSIS,
Dow Chemical U.S.A., Midland, MI.
R. O. Kagel.
IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 1-13, 1 fig, 1 tab, 21 ref.

Descriptors: *Pollutant identification, *Legal aspects, *Organic compounds, *Water analysis, Regulations.

There are sound technical arguments for the validation of priority pollutant methodology. These arguments are intricately entwined with legal issues that will ultimately be argued in the courts. The technical issues should be resolved by the technical community. The merits of these issues are what lawyers should be left to resolve, rather than the issues themselves. Roisman, former environmentalist lawyer who heads the Justice Department's toxic waste section, recently gave some guiding philosophy behind the government's legal-environmental movement in that area when he said: 'Government is perfectly prepared to punish the innocent for the sins of the guilty.' An analytical result may very well be the infinitesimally fine line that separates the guilty from the innocent. Unless the analytical methodology is properly validated and the result statistically meaningful, that fine dividing line might as well be determined by chance, a flip of the coin or a roll of the dice. (Author)
W86-03792

MASTER ANALYTICAL SCHEME: AN OVERVIEW OF INTERIM PROCEDURES,
Environmental Research Lab., Athens, GA.
A. W. Garrison, A. L. Alford, J. S. Craig, J. J. Ellington, and A. F. Haeberer.
IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 17-30, 1 fig, 2 tab, 5 ref.

Descriptors: *Pollutant identification, *Organic compounds, *Water analysis, *Chromatography, Master Analytical Scheme, Gas chromatography, Standards, Wastewater analysis, Effluents.

The Master Analytical Scheme (MAS) provides protocols for the gas chromatography/mass spectrometry analysis of purgeable, extractable, neutral intractable, and ionic intractable organics in surface and drinking water and in industrial, energy-related and municipal effluents. Nominal lower quantifiable limits are 0.1 micrograms/liter for drinking water, 1 microgram/liter for surface water, and 10 micrograms/liter for the effluents. One unique feature of the MAS is its comprehensiveness. Another is its qualitative-quantitative aspect--an extensive data base of response and re-

covery factors allows computer estimation of concentration without recourse to standards for each analyte. This interim MAS will be refined to correct deficiencies observed during analysis of environmental samples. (Author)
W86-03793

MASTER ANALYTICAL SCHEME: DEVELOPMENT OF EFFECTIVE TECHNIQUES FOR ISOLATION AND CONCENTRATION OF ORGANICS IN WATER,
Gulf South Research Inst., New Orleans, LA.
J. E. Gebhart, J. F. Ryan, R. D. Cox, E. D. Pellizzari, and L. C. Michael.
IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 31-48, 6 fig, 8 tab, 7 ref. 68-03-2704.

Descriptors: *Pollutant identification, *Organic compounds, *Water analysis, *Chromatography, Master Analytical Scheme, Gas chromatography, Amines, Carboxylic acids, Organic acids, Extraction, Ion exchange, Resins, Wastewater analysis.

The Master Analytical Scheme methodology states that a water sample for analysis of organic compounds is divided into a minimum of three aliquots. One aliquot is analyzed for purgeable or highly volatile compounds; one for intractable or water-soluble, nonextractable, nonpurgeable compounds; and one for extractable organics. Analysis of purgeable organics uses gas stripping followed by gas chromatography/mass spectrometry/computer using capillary columns. The intractables are divided into several types. Nonionic intractables (e.g., methanol) are isolated by fractional distillation and analyzed on a Carbowax 1500 column. Ionic intractables, separated by ion exchange resin techniques, include the following groups: volatile primary and secondary amines, volatile carboxylic acids, nonvolatile organic acids, and halogenated carboxylic acids. Three procedures are available for analysis of extractable organics: resin columns for clean samples, batch liquid/liquid extraction treated by a bottle-stirbar technique for more contaminated samples, and a flow-under continuous liquid/liquid extraction method for emulsion-forming samples. Recovery data are given for compounds fitting these categories.
W86-03794

MASTER ANALYTICAL SCHEME: AN ASSESSMENT OF FACTORS INFLUENCING PRECISION AND ACCURACY OF GAS CHROMATOGRAPHY/MASS SPECTROMETRY DATA,
Gulf South Research Inst., New Orleans, LA.
J. F. Ryan, J. E. Gebhart, L. C. Rando, D. L. Perry, and K. E. Tomer.
IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 49-66, 5 fig, 11 tab, 2 ref. 68-03-2704.

Descriptors: *Pollutant identification, *Organic compounds, *Water analysis, *Mass spectrometry, *Chromatography, Gas chromatography, Precision, Accuracy, Coefficient of variation, Master Analytical Scheme, Retention time, Standards, Amines, Hydrocarbons, Aromatic compounds, Phenolic compounds.

The data in this paper present the most significant aspects of the work on precision and accuracy in quantification. Results of a number of additional experiments that produced additional conclusions are: (1) Total ion current (TIC) relative response ratio values are no more precise than selected ion current (SIC) relative response ratio values; additionally, TIC quantification measurements are susceptible to error because of chromatographic peak heterogeneity. For these reasons, the Master Analytical Scheme is based on SIC relative response ratio values. (2) Mass difference between the selected quantifying ion of an internal standard and the selected quantifying ion of the unknown compound had no effect. No reduction was found in the percent coefficient of variation when the Dalton value separation was small rather than large. (3) No concentration dependence of relative response ratio was observed over a two-order-of-magnitude range. Although relative response ratio precision is not enhanced by a chemical similarity between internal standard and compound of interest, it is enhanced by the retention time proximity between the two. Finally, relative response ratio can vary considerably over different days (and be corrected when necessary) but be precise on a single day. (Author)
W86-03795

QUANTITATIVE ASPECTS OF THE MASTER ANALYTICAL SCHEME FOR ORGANICS IN WATER,
Research Triangle Inst., Research Triangle Park, NC. Analytical Sciences Div.
K. B. Tomer, J. T. Bursey, L. C. Michael, L. S. Sheldon, and E. D. Pellizzari.
IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 67-85, 3 fig, 14 tab, 5 ref. 68-03-2704.

Descriptors: *Pollutant identification, *Organic compounds, *Water analysis, Master Analytical Scheme, Chromatography, Quantitative analysis, Mass spectrometry, Wastewater analysis, Precision, Accuracy.

The first-generation Master Analytical Scheme has been applied to a series of water samples in one laboratory and to replicate water samples analyzed independently by three laboratories. The accuracy found was, on the most part, within the limits expected on the basis of propagation of error. The Master Analytical Scheme, therefore, promises to be an extremely useful tool for the qualitative-quantitative analysis of organics in a broad range of water samples. (Author)
W86-03796

QUALITY OF MASTER ANALYTICAL SCHEME DATA: PURGEABLES AND VOLATILE ORGANIC ACIDS,
Research Triangle Inst., Research Triangle Park, NC. Analytical Sciences Div.
L. C. Michael, R. Wiseman, and L. S. Sheldon.
IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 87-114, 11 fig, 14 tab, 5 ref. 68-03-2704.

Descriptors: *Pollutant identification, *Organic compounds, *Water analysis, Wastewater analysis, Master Analytical Scheme, Chromatography, Gas chromatography, Mass spectroscopy, Organic acids, Quality control, Standards.

Quality assurance procedures were applied to method development, validation, and application phases for purgeable and volatile acid segments of a Master Analytical Scheme for the analysis of organic compounds in water. Recovery data demonstrate the applicability of the various techniques to diverse water types. Error propagation estimates for purge-and-trap indicate a relative standard deviation of +23 to -28%, excluding gas chromatography/mass spectrometry/computer. A similar estimation for volatile acid analysis reveals a relative standard deviation of + or - 11%. For each sample to be analyzed, preanalysis sample scouting (headspace analysis for purgeables and conductivity measurements for volatile acids) was used to determine the optimum sample volume and level of internal standard to be added. Gas chromatography/mass spectrometry/computer analysis was performed to demonstrate the applicability of the purge-and-trap and volatile acid Master Analytical Scheme protocols to complex and diverse water types. A total of 19 environmental water samples, unspiked and spiked with mode compounds and deuterated internal standards, were analyzed. (Author)
W86-03797

DEVELOPMENT OF METHODS FOR PESTICIDES IN WASTEWATER: APPLICABILITY OF A GENERAL APPROACH,
Midwest Research Inst., Kansas City, MO.
H. Miller, P. Cramer, A. Drinkwine, A. Shan, and G. Trischan.
IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 115-138, 4 fig, 14 tab, 4 ref.

Descriptors: *Pollutant identification, *Wastewater analysis, *Pesticides, *Water analysis, Insecticides, Triazines, Carbamates.

A standard approach for analyzing pesticides in water and wastewater samples was developed and tested on several classes of compounds: organochlorine, organonitrogen, organophosphorous, triazines, and carbamates/ureas. The steps in the method utilized one-liter sample volumes extracted with three 60-ml aliquots of methylene chloride followed by Kuderna-Danish concentration, and standardized Florisil cleanup, if required. Generally, recoveries for clean water extraction, seven-day stability, and spiked wastewater were good. The major source of reduced recovery was cleanup. Some pesticides, particularly the organophosphorus type, were retained on the Florisil or alumina column. Detection limits obtained when using the protocol were as follows (concentrations in micrograms/liter): 0.1-1.0, 80%; 1-10, 94%; and 10-100, 100%. Analysis of a group of 10 triazines was given as a case study.
W86-03798

DETERMINATION OF PHENOLIC WATER POLLUTANTS BY GLASS CAPILLARY GAS CHROMATOGRAPHY,
W. Giger, and C. Schaffner.
IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor, MI. 1981. p 141-154, 6 fig, 2 tab, 14 ref.

Descriptors: *Pollutant identification, *Wastewater analysis, *Organic compounds, *Phenolic compounds, *Industrial wastewater, Chromatography, Gas chromatography, Quantitative analysis, Chlorophenols, Pulp wastes, Chemical wastewater.

A method for the quantitative determination of lipophilic phenols, including priority pollutants and consensus voluntary reference compounds, used methylene chloride extraction of the water sample using 2,4,6-tribromophenol as an internal standard, followed by gas chromatography with a flame ionization detector. Identification was by mass spectrometry. Recoveries were as follows: phenol, 29%; 2-chlorophenol, 83%; 2,4-dichlorophenol, 92%; 4-chloro-3-methylphenol, 46%; 2,4,6-trichlorophenol, 89%; 2,3,4,6-tetrachlorophenol, 92%; pentachlorophenol, 83%; 4-chlorophenol, 26%; 1-naphthol, <5%; 4-phenylphenol, <5%; and 2,6-di-tert-butyl-4-methylphenol, 60%. Chromatograms of several industrial wastewater samples are shown.
W86-03799

CHROMATOGRAPHIC CONSIDERATIONS FOR THE ANALYSIS OF ACID-EXTRACTABLE PRIORITY POLLUTANTS,
Hewlett-Packard Co., Avondale, PA. Avondale Div.
R. R. Freeman.
IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 155-169, 11 fig, 1 tab, 13 ref.

Descriptors: *Pollutant identification, *Wastewater analysis, *Organic compounds, *Phenolic compounds, Quantitative analysis.

Underivatized phenols were quantitatively analyzed at the microgram/liter level using fused-silica open tubular columns with a cool on-column sampling system. The chromatographic conditions were chosen to accomodate for the sample concentrations. Above 5 ng the suitable techniques were an on-column or splitless injection and a fused-silica open tubular column characterized by an acidic column (acid-to-neutral surface) coated with a gum nonpolar stationary phase. At this level glassware should be acid-deactivated for use with

chlorophenols and nitrophenols. At the sub-nanogram level the analysis was difficult but possible with on-column injection, a nonpolar fused-silica column, and a silica detector interface.
W86-03800

PART-PER-TRILLION ANALYSIS OF VOLATILE, BASE/NEUTRAL AND ACIDIC WATER CONTAMINANTS ON A SINGLE FUSED-SILICA CAPILLARY COLUMN,
Montgomery (James M.), Inc., Pasadena, CA.
A. R. Trussell, F-Y. Lieu, and J. G. Moncur.
IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 171-186, 6 fig, 2 tab, 3 ref.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, *Chromatography, Fused silica columns, Chlorinated hydrocarbons, Pesticides, Aromatic compounds.

The most commonly used chromatographic techniques for the analysis of purgeable and extractable organic water contaminants call for the use of four different packed columns. The techniques presented in this paper represent a simplified chromatographic procedure which yields improved sensitivity and resolution. A single fused-silica open tubular capillary column can be used for analysis of volatile, base/neutral/acidic, and pesticide fraction organic contaminants in water. Many of the compounds tested could be recovered from water at the low part-per-trillion level range. Considerable time saving is afforded by the use of the single column for both volatile and extractable water contaminants. Coinjection of both base/neutral and acid fractions in the same chromatographic run allows further time saving. (Author)
W86-03801

ANALYSIS OF POLYCHLORINATED BIPHENYLS BY GLASS CAPILLARY AND PACKED-COLUMN CHROMATOGRAPHY,
Environmental Research Lab.-Duluth, Grosse Ile, MI. Large Lakes Research Station.
M. D. Mullin, and J. C. Filkins.
IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 187-196, 8 fig, 25 ref. R-806579.

Descriptors: *Pollutant identification, *Organic compounds, *Polychlorinated biphenyls, *Chlorinated hydrocarbons, Aroclors, Chromatography, Glass capillary chromatography, Gas chromatography.

A high-resolution glass capillary gas chromatography was used to identify commercial polychlorinated biphenyl mixtures, Aroclors 1242 and 1260. Chromatographic conditions were varied to achieve desired results--higher pressure decreased analysis time but decreased resolution; hydrogen as a carrier gas produced shorter analysis times and greater sensitivity than nitrogen.
W86-03802

HIGH-RESOLUTION GAS CHROMATOGRAPHY AND NEGATIVE ION CHEMICAL IONIZATION MASS SPECTROMETRY OF POLYCHLORINATED BIPHENYLS,
Research Triangle Inst., Research Triangle Park, NC. Analytical Sciences Div.
E. D. Pellizzari, K. B. Tomer, and M. A. Moseley.
IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 197-218, 18 fig, 4 tab., 14 ref.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, *Polychlorinated biphenyls, Chlorinated hydrocarbons, Aroclors, Chromatography, Negative ion chemical ionization, Mass spectrometry, Gas chromatography.

An investigation into the preparation of better capillary columns for resolving polychlorinated biphenyl (PCB) isomers was conducted. Excellent resolution and temperature stability were obtained for an Apiezon L phase (0.1-micron film thickness) coated on a silanized surface of a Pyrex capillary 0.20 mm i.d. x 50 m in length. Studies were conducted on moderating and reagent gases used in negative ion chemical ionization/mass spectrometry for enhancing either m/z 35/37 or molecular ions of PCB using a magnetic sector and quadrupole gas chromatography/mass spectrometry systems. Open and closed sources were compared. Oxygen-enhanced methane gave best conditions for optimum molecular ion intensities, while pure methane was most suitable with an open source design for enhanced m/z 35.37. The combination of high-resolution gas chromatography and negative ion chemical ionization/mass spectrometry provides an instrumental method for environmental analysis which can be used for identifying or verifying PCB isomers, determining the number of chlorines in a chromatographic peak, and quantifying each individual isomer in a sample. (Author)
W86-03803

DETERMINATION OF PRIORITY POLLUTANTS IN INDUSTRIAL WASTEWATERS BY STABLE-ISOTOPE DILUTION GAS CHROMATOGRAPHY/MASS SPECTROMETRY,
S-Cubed, La Jolla, CA.
B. N. Colby, and A. E. Rosecrance.
IN: Advances in the Identification & Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 221-230, 3 fig, 5 tab, 3 ref. 68-02-3153, 68-02-2689.

Descriptors: *Pollutant identification, *Organic compounds, *Wastewater analysis, *Industrial wastewater, Isotope dilution, Chromatography, Gas chromatography, Mass spectrometry, Quality control, Standards.

Isotope dilution quantification was shown to improve precision, accuracy, and quality control in determination of priority pollutants in industrial wastewater compared with existing methods (internal standard and no internal standard). Tests were run on water solutions containing varying concentrations of benzene, toluene, chloroform, and 1,2-dichloroethane. Using actual wastewater samples spiked with labeled priority pollutants, it was demonstrated that isotope dilution produced the same recoveries as samples spiked with unlabeled compounds. The character and source of wastewater did not affect the precision or accuracy of the isotope dilution method. Incorporating isotope dilution into a quality control program would reduce the number of sample analyses by 70% without reducing the amount of data obtained.
W86-03804

STABLE ACTIVABLE TRACERS FOR ENVIRONMENTALLY SIGNIFICANT ORGANIC MOLECULES,
Oregon State Univ., Corvallis. Dept. of Chemistry.
L. M. Ghannam, W. D. Loveland, and D. J. Baumgartner.
IN: Advances in the Identification & Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 231-238, 3 fig, 2 tab, 20 ref.

Descriptors: *Pollutant identification, *Tracers, *Organic compounds, *Bioaccumulation, Oysters, Environmental tracers, Dysprosium compounds, Partition coefficients, Accumulation.

Dysprosium(III) trisdibenzolmethane monohydrate and dysprosium(III) triacetylacetonate trihydrate were tested as stable activable tracers for bioconcentration experiments. Both compounds remained soluble and undissociated for 10 days in seawater. Solubilities in octanol and in water for the trisdibenzolmethane compound were 6.176 and 0.006218, respectively; for the triacetylacetonate compound, 34.441 and 1.742, respectively. Octanol/water partition coefficients were 994 and 19.77 for the trisdibenzolmethane and triacetylacetonate compounds, respectively. Bioconcentration factors of the tracers in European oyster were in the same range as pesticides with similar partition coefficients.
W86-03805

MICROEXTRACTION AS AN APPROACH TO ANALYSIS FOR PRIORITY POLLUTANTS IN INDUSTRIAL WASTEWATER,
Southwest Research Inst., San Antonio, TX.
J. W. Rhodes, and C. P. Nulton.
IN: Advances in the Identification & Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1983. p 241-252, 1 fig, 3 tab, 5 ref.

Descriptors: *Pollutant identification, *Wastewater analysis, *Organic compounds, Extraction, Microextraction, Sample preparation.

A one-step extraction procedure (called microextraction) was developed for analysis of priority pollutants in wastewater samples. Extraction used 200-1000 microliters of solvent for a 10-100-ml sample. After agitation, a few microliters were removed from the organic phase for injection into a gas chromatograph. The microextraction technique showed several advantages over the exhaustive extraction: simplicity of extract preparation, minimal use of glassware and solvent, no problem with emulsions, no necessity for solvent concentration, and no column cleanup of extracts. Equations are given to calculate the extraction efficiency of a solute from a water sample.
W86-03806

EVALUATION OF THE MICROEXTRACTION TECHNIQUE TO ANALYZE ORGANICS IN WATER,
Little (Arthur D.), Inc., Cambridge, MA.
K. E. Thrun, and J. E. Oberholtzer.
IN: Advances in the Identification & Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p, 253-266, 7 fig, 6 tab, 4 ref. 68-01-5011.

Descriptors: *Pollutant identification, *Wastewater analysis, *Organic compounds, Sample preparation, Extraction, Microextraction, Phthalates, Industrial wastewater, Phenolic compounds, Benzene, Toluene, Ethylbenzene.

Microextraction of organics in water with small amounts of solvent (10-100 ml) and large sample-to-solvent ratios (100:1 or greater) was effective as a cleanup-concentration step in analytical procedures for a variety of compounds. Saturation of the solution with sodium sulfate improved recoveries of the substances studied: benzene, toluene, ethylbenzene, and o-xylene. Recoveries were generally high. However, recoveries that were low were quite reproducible. Using a spiked sample allowed correction for incomplete recovery. The microextraction technique is particularly suitable for nonvolatile substances that have relatively high partition coefficients (greater than 150 to obtain a 60% extraction efficiency at 100:1 sample-to-solvent ratio). The technique was tried on a latex wastewater spiked with solvents. Intermittent 2-min shaking for 15 min produced 56% recovery of benzene, 40% recovery of toluene, and 28% recovery of ethylbenzene. Additional shaking was necessary to increase recovery to at least 90%. Extraction efficiencies for microextraction of phenols from clean water were generally higher than found in other methods. A series of phthalates were recovered efficiently after shaking for 15 min.
W86-03807

FURTHER OPTIMIZATION OF THE PENTANE LIQUID-LIQUID EXTRACTION METHOD FOR THE ANALYSIS OF TRACE ORGANIC COMPOUNDS IN WATER,
North Texas State Univ., Denton. Dept. of Chemistry.
W. H. Glaze, R. Rawley, J. L. Burleson, D. Mapel, and D. R. Scott.
IN: Advances in the Identification & Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 267-280, 6 fig, 4 tab, 12 ref.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, *Chlorinated hydrocarbons, Extraction, Liquid/liquid extraction, Sample

preparation, Trihalomethanes, Pentane, Trace levels.

A second generation liquid/liquid extraction method is more convenient and rapid for routine trihalomethane analysis. It is also less sensitive to changes in pH and ionic strength. The method involves two steps: water removal and pentane addition using a needle-syringe arrangement. After this addition the bottle is shaken and allowed to stand so that the phases separate. In a third-generation procedure the water removal and pentane addition is done in an ultrasomic bath so that the pentane disperses into fine droplets as it enters the water. The second-generation method is used with organic halides; the third-generation method for hydrocarbons and organic halides.
W86-03808

EXTRACTION OF ORGANIC COMPOUNDS FROM WATER USING SMALL AMOUNTS OF SOLVENT,
Ames Lab., IA.
G. A. Junk, I. Ogawa, and H. J. Svec.
IN: Advances in the Identification & Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 281-292, 2 fig, 5 tab, 11 ref. W-7405-Eng-82.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, *Chlorinated hydrocarbons, Aromatic compounds, Alcohols, Aliphatic compounds, Hydrocarbons, Ketones, Pesticides, Extraction, Microextraction, Sample preparation.

A microextraction technique for organics in water is done in 100-ml or 1000-ml flasks having precalibrated necks with inside diameters of 2-10 mm. Pentane is used as the extracting solvent. Recoveries of model compounds (halocarbons, aromatic hydrocarbons, alcohols, alkanes, ketones, and pesticides) added to water are generally good, except for substances which are more soluble in water. Addition of methanol up to about 10% to halocarbons in water does not change extraction efficiency.
W86-03809

ANIONIC AND NEUTRAL ORGANIC COMPONENTS IN WATER BY ANION EXCHANGE,
Ames Lab., IA.
G. A. Junk, and J. J. Richard.
IN: Advances in the Identification & Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 295-315, 9 fig, 7 tab, 21 ref. W-7405-Eng-82.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, *Pesticides, *Ion exchange, Insecticides, Herbicides, Resins, Anion exchange, Rivers.

An anion exchange resin (XAD-4), modified by chloromethylation followed by amination with trimethylamine, was then converted from chloride to hydroxide form. This prepared resin was used to isolate organic neutral and anionic components from water samples. Neutral compounds were eluted with diethyl ether; anionic components with HCL-saturated ether. The technique was used to recover organic compounds from a variety of waters. Recoveries of aliphatic acids, nitrophenols, chlorophenols, and substituted sulfonic acids added to distilled water were 86-97%. Near 100% extraction efficiency of 2,4-D, tetrachloroterephthalic acid, and N-1-naphthylphthalamic acid was obtained in wastewater from a pesticide disposal pit. The same three chemicals were recovered at efficiencies of 84% or greater in water containing sodium choride or sodium sulfate at levels of 1% and 5%. The only exception was tetrachloroterephthalic acid, which had recoveries of 20-51% in sodium chloride solution. Anion exchange and resin sorption procedures compared favorably in isolation of a number of neutral pesticides in river water, reservoir water, and urban runoff. However, results with digester water were not as agreeable, probably because of microparticulate matter present.
W86-03810

THERMAL DESORPTION FROM A XAD-4 ADSORPTION SUBSTRATE FOR WATER ANALYSIS BY CAPILLARY GAS CHROMATOGRAPHY,
Ames Lab., IA.
J. P. Ryan, and J. S. Fritz.
IN: Advances in the Identification & Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 317-327, 3 fig, 2 tab, 8 ref. 7405-Eng-82.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, *Aromatic compounds, *Resins, Hydrocarbons, Ion exchange, Adsorption, Thermal desorption, Chromatography, Gas chromatography.

Thermal desorption of organic compounds from XAD resin using a glass capillary gas chromatograph column provided greater resolution (compared with a packed gas chromatograph column) of a sample containing fluorene, phenanthrene, anthracene, tritan, and pyrene. The final desorption temperature was 210 degrees C; the desorption time was 20 min; the flow rate was 42 ml/min. An isothermal desorption at 200 degrees C gave maximum recovery of the compounds in 15 min at a desorption flow of 80 ml/min. A sample of Ames, Iowa, tap water analyzed by the method produced sharp peaks for indene (0.70 ppb), alkyl indanes, naphthalene (0.28 ppb), 1-methylnaphthalene (0.35 ppb), acenaphthene, and acenaphthylene.
W86-03811

COMPARISON OF SEVERAL METHODS FOR COLLECTION AND QUANTIFICATION OF POLYCYCLIC AROMATIC HYDROCARBONS FROM AQUEOUS MEDIA,
Oak Ridge National Lab., TN. Analytical Chemistry Div.
J. E. Caton, Z. K. Barnes, H. Kubota, W. H. Griest, and M. P. Maskarinec.
IN: Advances in the Identification & Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 329-344, 4 fig, 7 tab, 21 ref. W-7405-eng-26.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, *Aromatic compounds, Polycyclic aromatic compounds, Extraction, Liquid/liquid extraction, Resins, Chromatography, Reverse-phase chromatography.

Several methods for isolation of polycyclic aromatic hydrocarbons in water samples were compared: liquid/liquid extraction (LLE), polystyrene sorbent resins, and silica chemically modified with octadecylsilane for reverse-phase chromatography. Carbon-14 tracer was added to the stock solution of organic compounds. Polycyclic aromatics included in the mixture were naphthalene, acenaphthylene, acenapthene, phenanthrene, anthracene, fluorene, fluoranthene, pyrene, 1,2-benzanthracene, chrysene, benzo(a)pyrene, 1,2,5,6-dibenzanthracene, and benzo(g,h,i)perylene. For simplicity and high recovery the three LLE methods were best. Two resin methods produced variable recovery, but needed pH and ionic strength control; they were not labor-intensive. The methods using reverse-phase material produced variable lower recoveries but were not labor-intensive.
W86-03812

ANOMALOUS BREAKTHROUGH OF BENZO(A)PYRENE DURING CONCENTRATION WITH AMBERLITE XAD-4 RESIN FROM AQUEOUS SOLUTIONS,
Savannah River Ecology Lab., Aiken, SC.
P. F. Landrum, and J. P. Giesy.
IN: Advances in the Identification & Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 345-355, 2 fig, 4 tab, 29 ref. EPA-78-D-X0290, DE-AC09-76SR00819.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, *Resins, Aromatic compounds, Polyaromatic hydrocarbons, Ion exchange, Benzo(a)pyrene, Humic acids, Fulvic acids, Dissolved solids.

The study indicates that dissolved minerals (e.g., iron) and organics (e.g., humic and fulvic acids) can drastically alter the trapping efficiency and recovery of benzo(a)pyrene on Amberlite XAD-4 resin. This decreased trapping of a nonpolar compound is anomalous with the expected result. The influence of the abovementioned enviromental factors appears to increase with the decreased water solubility of the compound. There seems to be a hydrophobicity limit below which no apparent effect occurs. The more insoluble compounds are sorbed to particulates and dissolved organics which alter their trapping and elution efficiency on Amberlite XAD-4 resin. Thus, monitoring studies evaluating the amount of benzo(a)pyrene and perhaps polyaromatic hydrocarbons of equal or lower water solubility utilizing Amberlite XAD-4 resin for concentration must evaluate trapping and elution efficiency for the water to be studied. (Author)
W86-03813

HIGH-PERFORMANCE LIQUID CHROMATOGRAPHIC ANALYSIS OF NITROPHENOLS,
Allgemeine Elektricitaets-Gesellschaft AEG Telefunken, Frankfurt am Main (Germany, F.R.).
A. F. Haeberer, and T. A. Scott.
IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 359-370, 5 fig, 1 tab, 9 ref.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, *Resins, *Phenolic compounds, *Nitrophenols, Chromatography, Ion exchange, Cesium silicate chromatography, Dye industry wastes, Liquid chromatography.

A reverse-phase high performance liquid chromatography method has been developed for the analysis of nitrophenols in water samples. The compounds are accumulated on mixed XAD 4/8 macroreticular resins followed by Kuderna-Danish evaporation. Cesium silicate chromatography facilitates the separation of phenolics from neutral and basic interfering substances. This cleanup method allows recovery of about 80% at the 10-ppb level. Chromatograms are shown for analyses from fortified and unfortified dye plant effluent, municipal effluent, and plastics industry extract. Compounds found in the plastic industry extract are phenol, 2-nitrophenol, 4-nitrophenol, 2-nitro-p-cresol, 2,4,6-trichlorophenol, and pentachlorophenol in a range of 7 to 260 ppb each.
W86-03814

SIZE EXCLUSION, REVERSE-PHASE AND WEAK ANION EXCHANGE CHROMATOGRAPHY OF NATIONAL ORGANICS IN WATER,
North Texas State Univ., Denton. Dept. of Chemistry.
W. H. Glaze, P. C. Jones, and F. W. Saleh.
IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 371-382, 6 fig, 1 tab, 13 ref.

Descriptors: *Pollutant identification, *Water analysis, *Organic matter, Fulvic acids, Humic acids, Chromatography, Ion exchange, Resins, Size exclusion chromatography, Ozonation.

A progress report on the study of the structure of aquatic humus is presented. Several high-performance liquid chromatography methods are evaluated for separation prior to using structure elucidation tools. A polynodal molecular size distribution for the humic material is not observed in size exclusion chromatography, provided ionic strength and column-solute effects are controlled. Reverse-phase separation of aquatic humus before and after ozonation shows the separation of several components, none of which have been identified. Weak anion exchange material analysis shows three peaks. As the molecular size of the components increases, the ratio of trihalomethane formation potential to total organic carbon also increases.
W86-03815

DEVELOPMENT OF TECHNIQUES FOR THE ISOLATION AND IDENTIFICATION OF NON-VOLATILE ORGANICS IN DRINKING WATER,

Water Research Centre, Medmenham (England). Medmenham Lab.
C. D. Watts, B. Crathorne, R.I. Crane, and M. Fielding.

IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 383-397, 4 fig, 2 tab, 4 ref.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, Chromatography, Liquid chromatography.

A procedure is being developed for characterization of nonvolatile organics in drinking water. While the procedure is slow, it has the required sensitivity and specificity for identifying a wide range of compounds. The water sample is freeze dried and the residue extracted with methanol. Salts are removed with ion exchange resins either before freeze drying or from the methanol extract. The cleaned up extract is separated according to polarity by high performance liquid chromatography. The halogen-containing compounds are characterized separately from the high-ultraviolet absorbing fractions. The latter are subjected to mass spectrometry. This work, still in progress, will further explore the use of field desorption mass spectrometry in combination with collisional activation and linked scanning techniques for further identification of compounds in fractions.
W86-03816

EVALUATION OF TRACE ENRICHMENT METHODOLOGY IN CONJUCTION WITH REVERSE-PHASE HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY FOR PRECONCENTRATION, SEPARATION AND QUANTIFICATION OF TRACE NON-VOLATILE ORGANIC COMPOUNDS IN AQUEOUS ENVIRONMENTAL SAMPLES,

Environmental Research Lab., Athens, GA.
J. A. Graham, and A. W. Garrison.

IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 399-432, 17 fig, 6 tab, 48 ref.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, Chromatography, Wastewater analysis, Resins, Trace levels, Liquid chromatography.

The analytical capabilities of trace enrichment on octadecyl-derivatized silica in conjunction with reverse-phase high-performance liquid chromatography was evaluated for routine analysis of trace nonvolatile organic compounds in water. Model compounds were determined in drinking water at 0.1- to 1-ppb levels with outstanding precision. Addition of ion-pairing reagent to the sample increased the recoveries for acidic compounds. Volumetric accumulation rates as high as 7.5 ml/min could be used without significant decrease in recovery. Although large sample volumes, 500-2000 ml, could be enriched, it was generally not necessary. Two problems were exposed during these studies. (1) A large amount of material was retained on the colums. The liquid chromatographic system could not handle the large amount of material recovered from treated municipal sewage. (2) Unexplainable variations in the recoveries of compounds enriched from different matrices limited the accuracy with which the methodology could be applied to quantitative determinations.
W86-03817

HIGH-PERFORMANCE LIQUID CHROMATOGRAPHIC DETERMINATION OF NITROSAMINES IN WATER AND WASTEWATER,

Environmental Research Lab., Athens, GA.
A. F. Haeberer, and T. A. Scott.

IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 433-445, 8 fig, 2 tab, 6 ref.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, Wastewater analysis, *Nitrosamines, Chromatography, Resins, Ion exchange, Liquid chromatography.

The determination of N-nitrosamines as the fluorescent derivatives of 7-chloro-4-nitrobenzo-2-oxa-1,3-diazole (NBD) shows some promise if loss of the intermediate amine salt can be minimized during the drying procedure or if only the nonvolatile N-nitrosamines are of interest. 1-Bromo-2-chloroethane was chosen as internal standard. The photoconductivity detector response curves are linear over three orders of magnitude. Resin accumulation produced 25-30% higher recoveries (46-83%) than classical liquid/liquid extraction for 1-ppb levels of the more hydrophilic N-nitrosamines (N-nitrosodimethylamine, N-nitrosomorpholine, N-nitrosopyrrolidine, N-nitrososiethylamine, N-nitrosopiperidine). Recoveries of a second group of N-nitrosamines at 0.4 ppb concentration ranged from 22% for N-n-butyl-N'-nitro-N-nitrosoguanidine to 84% for N-nitrosopiperidene. Compounds with recoveries of 70-82% included nitrosppiperazine, N-nitrosopyrrolidine, N-nitrosodiethylamine, N-nitroso-N-methylaniline, and N-nitrosodipyrpylamine.
W86-03818

DEVELOPMENTS IN THE ANALYSIS OF PRIORITY POLLUTANTS BY LIQUID CHROMATOGRAPHY/MASS SPECTROMETRY AND IMMUNOASSAY PROCEDURES,

National Bureau of Standards (NML), Gaithersburg, MD.
R. G. Christensen, H. S. Hertz, D. J. Reeder, and E. White.

IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 447-453, 2 fig, 5 ref.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, Chromatography, Immunoassay, Fluroimmunoassay, Aromatic compounds, Bioassay, Mass spectrometry.

Two methods of analyzing organic priority pollutants are liquid chromatography/mass spectrometry and fluoroimmunoassay. In the chromatography system solvent is concentrated by allowing it to flow down a heated stationary wire. The residual liquid is drawn into the mass spectrometer, spraying from a needle valve. Tests with a mixture of phenanthrene, 9-methylanthracene, and fluoranthene show a 20-fold concentration. Results are also given for analysis of shale oil components. Present work with fluroimmunoassay and dinitrophenol has allowed analysis at the 100-microgram/liter level. For use in pollutant analysis, the sensitivity must be increased to the submicrogram/liter or picogram/liter level.
W86-03819

DETECTION AND QUANTIFICATION OF ELECTROPHILES IN ENVIRONMENTAL SAMPLES: LABELING OF POTENTIAL MUTAGENS IN DRINKING WATER BY 4-NITROTHIOPHENOL,

Minnesota Univ., Navarre. Gray Freshwater Biological Inst.
A. M. Cheh, and R. E. Carlson.

IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 457-465, 3 fig, 15 ref.

Descriptors: *Pollutant identification, *Water analysis, *Mutagens, Nitrophenol, Tracers, Environmental tracers.

4-Nitrophenol may be used to label electrophiles in drinking water concentrates. This labeling may be used to distinguish between thioethers formed by rapid or slow electrophile reaction with nitrophenol. Correlation of changes in the labeling pattern with changes in mutagenic activity measured by the Ames assay suggests that the more rapidly reacting electrophiles may possess unusual mutagenic activity and may be present at extremely low concentrations.
W86-03820

DETERMINATION OF LINEAR ALCOHOL ETHOXYLATES IN WASTEWATER AND SURFACE WATER,

Procter and Gamble Co., Cincinnati, OH.
V. T. Wee.

IN: Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. p 467-479, 3 fig, 3 tab, 16 ref.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, *Surfactants, Neodol-45, Fate of pollutants.

An analytical method was developed for determining linear alcohol ethoxylates (carbon chain length, 14-15; ethylene oxide chain length, 7). It included a cleanup procedure followed by gas chromatography of the hydrogen bromide cleavage products of the surfactant. Results obtained from the method, which overestimates the concentration of linear alcohol ethoxylates. Morning influent samples from a domestic wastewater treatment plant contained 0.19 to 0.37 ppm of the surfactant; morning effluent, 0.006-0.012 ppm; afternoon influent, 0.47 ppm; afternoon effluent, 0.0085 ppm; activated sludge, 0.22 ppm; above sewage outfall, 0.0005 ppm; below sewage outfall, 0.0011 ppm; and river water, 0.0042 ppm.
W86-03821

ASSESSMENT OF THE MEASUREMENT UNCERTAINTY IN THE ESTIMATION OF STREAM REAERATION RATE COEFFICIENTS USING DIRECT TRACER TECHNIQUES,

National Council of the Paper Industry for Air and Stream Improvement, Inc., Medford, MA.
J. S. Hovis, R. C. Whittemore, L. C. Brown, and J. J. McKeown.

In: Proceedings of Stormwater and Water Quality Management Modeling Users Group Meeting, March 25-26, 1982, Washington, DC. EPA-600/9-82-015, August 1982. p 36-53, 1 fig, 5 tab, 22 ref.

Descriptors: *Reaeration rate, *Instream aeration, Aeration, *Tracers, *Precision, *Error analysis, Errors, Accuracy.

The purpose of this research is to elucidate the major sources of error in the direct tracer methods of reaeration rate coefficient measurement. The error components in the direct tracer measurements fall into three broad categories: (1) protocol selection errors (accuracy considerations), (2) parameter estimation and reaeration model errors, and (3) random experimental errors (precision considerations). The significance of the propagation of random error through the reaeration coefficient calculation was demonstrated via an analysis of the effect of the amount of tracer gas lost on the reaeration coefficient's theoretical precision. In addition, theoretical calculations showing the length of time a radiotracer study must be followed in order to achieve a desired precision in the measured rate were presented. Actual direct tracer reaeration measurements ranged from + or - 1.0% to + or - 1000% (the former from replication studies at a moderate rate, the latter from a single low rate measurement on the Ouachita River). Errors in the hydrocarbon technique measurements ranged from + or - 4.3% to + or - 230% (the former from the Wisconsin replication study, the latter from a single measurement on the Ouachita River). The relationship between the amount of tracer gas lost and the measurement uncertainty of the Ouachita River Basin radiotracer measurements was found to parallel the theoretical precision calculations.
W86-03824

HYDROLOGIC MODELING FOR STUDIES OF POLLUTANT LOADINGS AND TRANSPORT IN LARGE RIVER BASINS,

Northern Virginia Planning District Commission, Annandale.
A. Cavacas, J. P. Hartigan, E. Southerland, and J.

Group 5A—Identification Of Pollutants

A. Friedman.
In: Proceedings of Stormwater and Water Quality Management Modeling Users Group Meeting, March 25-26, 1982, Washington, DC. EPA-600/9-82-015, August 1982. p 69-89, 14 fig, 3 tab, 18 ref.

Descriptors: *Mathematical models, *Hydrologic models, *Hydraulic models, *Pollution load, Hydrology, Chesapeake Bay.

This research describes the calibration/verification of the hydrology component of the River Basin Model. The continuous simulation hydrologic model was linked with a water quality model for studies of nonpoint pollution loadings and the transport of nutrient and organic loadings in tributary watersheds of the Chesapeake Bay. The River Basin Model represents the Susquehanna, Potamac, and James river basins as well as 33 other river basins which contribute freshwater inflows, nonpoint pollution loadings, and wastewater discharges to the Bay. The Model was used by the EPA Chesapeake Bay Program for assessments of management strategies for nonpoint pollution and wastewater treatment. This paper focuses on the hydrology/hydraulics modeling requirements for the river basin water quality modeling studies.
W86-03827

MEASUREMENT OF NUTRIENT CONCENTRATIONS IN SEDIMENT PORE WATER COLLECTED BY A DIALYSIS SAMPLER,
Japan Bottom Sediment Management Association, Tokyo.
Y. Kurimoto, and T. Kotake.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/Japan Experts Meeting. March 1985. p 150-160, 14 fig, 2 tab.

Descriptors: *Nutrients, *Cycling nutrients, *Interstitial water, Sediment sampler, Chemical analysis, Chemical composition.

In the release mechanism of nutrients it sometimes becomes necessary to investigate the behavior of nutrients in sediment pore water. In the past, the separation of pore water from sediment has been performed using the centrifuge or a filter press procedure. These methods release nutrients dynamically by artificial forces during water separation. However, the release action of nutrients from sediment pore waters using a dynamic (centrifuge) versus a static (dialysis) method will have a large effect on the results. Dynamic separation methods may not accurately reflect the actual static nutrient release processes occurring in nature. To solve this problem, a static separation was developed using a dialysis sampler. The results of comparative tests showed that the measured concentrations from centrifuge separation were larger than those using the dialysis sampler. These results suggest that nutrients are released dynamically during the centrifuge separation. (Halterman-PTT)
W86-03877

ACCUMULATION OF ACRYLAMIDE INTO FISH,
Tsukuba Univ. (Japan). School of Medicine.
For primary bibliographic entry see Field 5C.
W86-03878

WATER POLLUTION: INDUSTRY AND GOVERNMENT WORKING TOGETHER - A CASE STUDY OF MUNCIE, INDIANA'S INDUSTRIAL PRETREATMENT PROGRAM,
J. M. Craddock.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-142307, Price codes: A10 in paper copy, A01 in microfiche.
IN: Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment, March 25-27, 1980, Dallas, Texas. Robert S. Kerr Environmental Research Lab., Ada, OK, April 1981. p 214-229, 4 fig.

Descriptors: *Water treatment, *Water treatment facilities, Wastewater facilities, Sludge, Septic sludge, Sludge disposal, Land disposal, Heavy metals, Sewer systems, Wastewater treatment.

A joint program of water quality control, involving a metropolitan sewer district (MSD) and a Department of Water Quality (DWQ) is described. The responsibilities of the DWQ include: perform all lab testing for wastewater treatment plant; monitor the industrial dischargers using the MSD sewage system and wastewater treatment plant; enforce the applicable MSD ordinances relating to sewer use and pretreatment, and develop new ordinances if necessary; and monitor all streams and locate illegal dischargers. The sewer district portion of the joint project included a program to monitor uptake of heavy metals by crops grown in sludge-application fields, a study in which heavy metal concentrations in fish were monitored, and a program by which the effects of the sewage district discharges were assessed by monitoring benthic macroinvertebrate communities. (Halterman-PTT)
W86-03898

5B. Sources Of Pollution

ROLE OF ENVIRONMENTAL TRANSPORT AND FATE MODELS IN IMPLEMENTING THE TOXIC SUBSTANCES CONTROL ACT,
Environmental Protection Agency, Washington, DC. Office of Pesticides and Toxic Substances.
W. P. Wood.
IN: Modeling the Fate of Chemicals in the Aquatic Environment, Ann Arbor Science, Ann Arbor, MI. 1982. p 49-58, 2 fig.

Descriptors: *Model studies, Pollutants, *Toxicity, Aquatic environment, Ecosystems, Distribution, Public health aspects, Mathematical models, Regulations, Legal aspects.

Various aspects of implementing the Toxic Substances Control Act are discussed, with emphasis on modeling activities. The Office of Toxic Substances is currently engaged in modeling activities which include identification of toxic materials, evolution of toxicity, modification and/or development, implementation, and validation. The choice of specific models for the various programs is based on selected criteria, including the following considerations: model input data requirements and accessibility of data; existence of computer code and technical support documentation; prior use in regulatory decision-making; use by other EPA program offices; skill level and level of effort required in exercising the model; and available validation studies. (Halterman-PTT)
W86-03420

PREDICTIVE FATE MODELS: THEIR ROLE IN THE U.S. ENVIRONMENTAL PROTECTION AGENCY'S WATER PROGRAM,
Environmental Protection Agency, Washington, DC. Office of Water Planning and Standards.
M. W. Slimak, and C. Delos.
IN: Modeling the Fate of Chemicals in the Aquatic Environment, Ann Arbor Science, Ann Arbor, MI. 1982. p 59-71, 3 fig, 1 tab, 17 ref.

Descriptors: *Model studies, Pollutants, *Toxicity, Aquatic environment, *Fate of pollutants, Prediction, Path of pollutants, Public health aspects, Legal aspects.

The most important areas considered in the predictive fate models used in the U.S. Environmental Protection Agency's water program include the following: partitioning between environmental media; metals speciation; organic chemicals in aquatic systems; runoff; and solid waste disposal. The role of models used to make predictions in these areas is described, and the projects in which these modeling efforts are conducted and outlined. The projects include regulating drinking water, controlling point-source discharges of chemicals to surface waters, managing the appropriate design, construction and maintenance of sewage treatment plants and evaluating the role of nonpoint-source pollution, and enforcing the regulations emanating from the various water offices responsible for these programs. (Halterman-PTT)
W86-03421

IDENTIFICATION AND EVALUATION OF FUNDAMENTAL TRANSPORT AND TRANSFORMATION PROCESS MODELS,
Environmental Research Lab., Athens, GA.
L. A. Burns.
IN: Modeling the Fate of Chemicals in the Aquatic Environment, Ann Arbor Science, Ann Arbor, MI. 1982. p 101-126, 3 fig, 84 ref.

Descriptors: *Model studies, *Path of pollutants, Pollutants, Hydrodynamics, Sorption, Sediment transport, Volatility, Hydrolysis, Prediction, Toxicity.

The current state of knowledge of those aspects of transformation and transport processes required for inclusion in environmental models are outlined. Physical processes include hydrodynamic transport, sorption, sediment transport, benthic boundary layer transport, and volatilization. Chemical processes include direct photolysis, indirect photolysis, hydrolysis and reduction. Biological processes of concern are microbial transformations, algal transformations, biosorption, and bioaccumulation. This second order or system-independent approach makes it possible to study the fundamental chemistry of compounds in the laboratory and then, based on independent studies of the driving forces in aquatic systems, evaluate the probable behavior of the compound in systems that have never been exposed to them. (Halterman-PTT)
W86-03422

SIGNIFICANCE AND LIMITATIONS OF ENVIRONMENTAL COMPARTMENTALIZATION MODELS IN THE CONTROL OF NEW CHEMICALS BASED ON THE ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT MINIMUM PREMARKETING SET OF DATA,
Umweltbundesamt, Berlin (Germany, F.R.).
For primary bibliographic entry see Field 5G.
W86-03423

EVALUATIVE MODEL FOR ESTIMATING ENVIRONMENTAL FATE,
Dow Chemical Co., Midland, MI. Environmental Sciences Research Lab.
W. B. Neely, and D. Mackay.
IN: Modeling the Fate of Chemicals in the Aquatic Environment, Ann Arbor Science, Ann Arbor, MI. 1982. p 127-143, 2 fig, 7 tab, 22 ref.

Descriptors: *Model studies, Pollutants, *Fate of pollutants, Hydrodynamics, Toxicity, Fate of pollutants, Aquatic environment, *Path of pollutants, Prediction.

An evaluative model that may be used in the initial assessment of exposure is described and discussed. The role of this model in a tiered approach to hazard assessment is described, and the importance of its being easy to use, economical, understandable by all concerned, and capable of producing results that are comparable between laboratories is stressed. Use of this model allows investigators to rank chemicals on a scale that will have the same meaning, regardless of the location of the study. Furthermore, the calculation presented may be performed on any programmable hand calculator. (Halterman-PTT)
W86-03424

FATE AND TRANSPORT MODELING FOR TOXIC SUBSTANCES,
Iowa Univ., Iowa City. Dept. of Civil and Environmental Engineering.
J. L. Schnoor, N. B. Rao, K. J. Cartwright, and R. M. Noll.
IN: Modeling the Fate of Chemicals in the Aquatic Environment, Ann Arbor Science, Ann Arbor, MI. 1982. p 145-163, 12 fig, 1 tab, 11 ref.

Descriptors: *Model studies, Pollutants, *Pesticides, Alachlor, Atrazine, Dieldrin, Aquatic environment, Ecosystems, *Fate of pollutants, *Path of pollutants.

The testing and validating of a model of the fate and transport of toxics is discussed. A field validation study is described, as well as microcosm and laboratory studies, which were used to supplement field data collections under spring run-off conditions. The study-design presented was also developed to determine if laboratory-derived rate constants could be used directly in a field validation effort. The studies focused on simulating the pesticides alachlor, atrazine and dieldrin. The laboratory biodegradation tests were accurate within a factor of five in a field application of the model. The microcosm studies were successful in reproducing bioconcentration effects, but microcosms should not be relied on for fate studies because of the large growth of biomass that inevitably results. (Halterman-PTT)
W86-03425

SIMPLIFIED MODEL OF THE FATE OF PARTITIONING CHEMICALS IN LAKES AND STREAMS,
HydroQual, Inc., Mahwah, NJ.
D. M. Di Toro, D. J. O'Connor, R. V. Thomann, and J. P. St. John.
IN: Modeling the Fate of Chemicals in the Aquatic Environment, Ann Arbor Science, Ann Arbor, MI. 1982. p 165-190, 5 fig, 2 tab, 8 ref.

Descriptors: *Model studies, Pollutants, Aquatic environment, Ecosystems, *Fate of pollutants, *Path of pollutants, Sorption, Sedimentation, Sediment transport, Sediments, Silt, Silt load.

The problem of analyzing the fate of chemicals discharged into receiving waters, specifically lakes and streams, is addressed. The focus is on contemporary industrial chemicals and the mechanisms that affect their distribution in the aquatic environment. Since these chemicals are associated with suspended and sedimented particles, the analyses include these mechanisms as an integral of the formulation, as well as the other kinetic, transfer and transport processes of importance. The primary factors included in the model are sediment capacity ratio, particulate concentration ratio, unequal particulate concentration ratio, sediment decay, and unequal partitioning. The application of this model to streams and rivers is illustrated. (Halterman-PTT)
W86-03426

HYDROLOGIC TRANSPORT MODELING,
Hydrocomp, Inc., Mountain View, CA.
N. H. Crawford.
IN: Modeling the Fate of Chemicals in the Aquatic Environment, Ann Arbor Science, Ann Arbor, MI. 1982. p 199-214, 8 fig, 19 ref.

Descriptors: *Model studies, *Path of pollutants, *Fate of pollutants, *Aquatic environment, *Hydrologic models, Management planning, Environmental policy, Pollutants, Prediction, Hydrodynamics.

A summary of the development of hydrologic transport modeling (and the current state-of-the-art) as well as the prospects for large scale use of models in environmental regulation, is presented. Historic developments and new trends in model algorithms are described and the regulatory use of models and future directions for model development are discussed. Continuous and steady-state models, benefits and cost analysis, and legal and physical considerations in large-scale model applications are emphasized. Problems in the areas of data gathering, calibration, geographic variability and error assessment for intensive use of models are discussed. (Halterman-PTT)
W86-03427

MODELING CHEMICAL REACTIONS AND TRANSPORT IN GROUNDWATER SYSTEMS: A REVIEW,
Rice Univ., Houston, TX. Dept. of Environmental Science and Engineering.
P. B. Bedient, N. K. Springer, C. J. Cook, and M. B. Thomson.
IN: Modeling the Fate of Chemicals in the Aquatic Environment, Ann Arbor Science, Ann Arbor, MI. 1982. p 215-246, 6 fig, 2 tab, 50 ref.

Descriptors: *Groundwater, Pollutants, *Model studies, *Fate of pollutants, *Path of pollutants, Distribution patterns, Microbial degradation, Sorption, Kinetics, *Groundwater movement.

The governing equations of groundwater flow and transport are described, followed by a presentation of chemical reaction processes. Mathematical models, both analytical and numerical, are discussed in detail, followed by model applications and field validation problems. Two primary situations where the equations governing groundwater flow and transport can be used are: to assess the impact of subsurface waste disposal at proposed sites that have not yet been contaminated; and to assess the impact of already contaminated sites in terms of predicting plume migration and recommending remedial measures. The specific chemical and biological processes that were included in the model development include phase equilibrium, kinetics, sorption of organic and inorganic pollutants, and the removal or transformation of organic pollutants from the subsurface environment through the action of microorganisms. (Halterman-PTT)
W86-03428

COMPLEX EFFLUENT FATE MODELING,
Wyoming Univ., Laramie. Dept. of Zoology and Physiology.
H. L. Bergman, and J. S. Meyer.
IN: Modeling the Fate of Chemicals in the Aquatic Environment, Ann Arbor Science, Ann Arbor, MI. 1982. p 247-267, 7 fig, 1 tab, 32 ref.

Descriptors: *Fate of pollutants, *Model studies, Pollutants, Aquatic environment, Ecosystems, Effluents, Mathematic models, Physical models, Path of pollutants, Spatial distribution.

The complex-effluent problem of modeling the fate of potentially hazardous chemical constituents found in complex-effluent mixtures is discussed. To further define this problem and the concept of a complex effluent, it is suggested that an effluent is truly complex when one or both of the following conditions apply: a number of potentially hazardous chemical constituents cannot be identified within reasonable time or cost; and a reasonable possibility exists that the environmental fate of a number of constituents could be affected markedly by complex kinetic interactions, such as synergism. It is suggested that the objectives of a complex-effluent modeling strategy should be to identify constituents posing an environmental fate problem, and to predict expected exposure concentration of each constituent posing a problem. The modeling problem posed by complex-effluent mixtures are illustrated by providing some examples, reviewing modeling strategies, and discussing trade-offs between mathematical and physical models. (Halterman-PTT)
W86-03429

TESTING MODELS OF THE FATE OF CHEMICALS IN AQUATIC ENVIRONMENTS,
Georgia Univ., Athens. Inst. of Ecology.
R. R. Lassiter.
IN: Modeling the Fate of Chemicals in the Aquatic Environment, Ann Arbor Science, Ann Arbor, MI 1982. p 287-301, 5 fig, 4 tab, 9 ref.

Descriptors: *Fate of pollutants, *Model studies, Pollutants, Aquatic environment, Ecosystems, Effluents, Mathematic models, Physical models, *Path of pollutants, Spatial distribution.

Testing models of the environmental fate of chemicals to provide a basis for judging their adequacy for a given purpose is discussed. The focus of this discussion is on theoretical models, which do not depend on prior observation for their ability to predict, but on the existence of relevant theory. An approach to model testing is described which entails the following steps: design the content of the model test; devise a statement of no difference between model predictions and observations; use regression of observations on predictions and test working-level null hypotheses of intercept equals 0 and slope equals 1; and, finally, interpret tests and draw conclusions. (Halterman-PTT)
W86-03430

FIELD VALIDATION AND ERROR ANALYSIS OF CHEMICAL FATE MODELS,
Anderson-Nichols and Co., Inc., Palo Alto, CA.
A. S. Donigian.
IN: Modeling the Fate of Chemicals in the Aquatic Environment, Ann Arbor Science, Ann Arbor, MI. 1982. p 303-323, 6 fig, 1 tab, 3 ref.

Descriptors: *Fate of pollutants, *Path of pollutants, *Model studies, *Model testing, Aquatic environment, Pollutants, Ecosystems, Prediction, Hydrologic models, Groundwater, Errors.

An overview of concepts that should be considered in any validation or verification effort of chemical fate models in any model application to problems of chemical fate and persistence in the environment, is presented. The primary focus is on models of physical, chemical and biological processes that effect the fate and transport of chemicals in terrestrial and aquatic systems. Validation, or verification, is discussed in terms of common procedures currently used and of the ultimate goal or purpose of model validation. Emphasis is on error analysis, i.e., investigation of the source of errors, or differences between model results and observed data. Various categories of errors are discussed and examples are presented. (Halterman-PTT)
W86-03431

FIELD VALIDATION OF EXPOSURE ANALYSIS MODELING SYSTEM (EXAMS) IN A FLOWING STREAM,
Procter and Gamble Co., Cincinnati, OH.
L. M. Games.
IN: Modeling the Fate of Chemicals in the Aquatic Environment, Ann Arbor Science, Ann Arbor, MI. 1982. p 325-346, 10 fig, 2 tab, 10 ref.

Descriptors: *Model studies, *Fate of pollutants, *Path of pollutants, Aquatic environment, Pollutants, Mathematical models, Prediction, Sedimentation, Kinetics, Linear alkylbenzene sulfonate, LAS.

Because of the complexity of the aqueous environment and the numerous processes that can occur, field validation studies should be done in a way that limits the variables involved. An attempted field validation of an evaluative model (the U.S. Environmental Protection Agency's EXAMS model), which it was hoped would meet these criteria, is described. The focus of this work is on the data required to use the model and a sensitivity analysis for several laboratory-measured variables plus a single-model calibration term. Test results indicate that, unfortunately, the model calculations are most sensitive to the least understood parameters that were provided as input: the dispersion coefficient and sediment biodegradation rate constants. Improvements in modeling will depend on a better understanding of these phenomena. (Halterman-PTT)
W86-03432

ASSESSMENT OF TRANSPORT AND FATE OF TOXIC MATERIALS IN AN EXPERIMENTAL STREAM ECOSYSTEM,
Michigan State Univ., East Lansing.
W. E. Cooper, and R. J. Stout.
IN: Modeling the Fate of Chemicals in the Aquatic Environment, Ann Arbor Science, Ann Arbor, MI. 1982. p 347-378, 19 fig, 6 tab, 1 ref.

Descriptors: *Model studies, *Model testing, Aquatic environment, Pollutants, Ecosystems, Prediction, *Fate of pollutants, *Path of pollutants, Biodegradation, Degradation.

The diversity of system responses that might be observed when stressing a large ecosystem with a toxicant is demonstrated. The benefits of a recycling system, as opposed to a flow-through system, are discussed. Results of artificial stream studies indicate that p-cresol caused significant shifts in DO, pH, bacterial densities and algal biomass.

These caused diurnal oscillations in biodegradation of p-cresol, which resulted in no steady-state conditions; therefore, no constant rate functions would serve as adequate model parameters. Models utilizing degradation rates that are functions of state variables, and therefore are time varying, are required to predict the observed results. The need for more data on various factors affecting degradation, before the utility of physical and mathematical models of the fate, transport and effects of organic toxicants can be evaluated, is discussed. (Halterman-PTT)
W86-03433

LEGAL VALIDATION OF ENVIRONMENTAL FATE MODELS,
ERM-Southeast, Inc., Brentwood, TN.
For primary bibliographic entry see Field 5G.
W86-03434

CORPUS CHRISTI INNER HARBOR WATER QUALITY SURVEY, AUGUST 1982,
Texas Dept. of Water Resources, Austin.
J. W. Bowman, and D. A. Jensen.
LP-197, January 1985. 94 p, 28 fig, 13 tab, 1 append.

Descriptors: *Harbors, *Texas, *Water pollution sources, *Water quality, *Surveys, Surface water, Hydrologic data, Cimatology, Chemical analysis, Bottom sediments, Metals, Pesticides, Bacterial analysis, Heavy metals, Volatile solids, Oil, Grease, Benthos, Benthic fauna, Nutrients, Contamination, Corpus Christie(Texas).

As part of continuing surveillance and effort to maintain and enhance the quality of Texas' surface water, District 12 of the Texas Department of Water Resources conducted a water quality survey of the Corpus Christi Inner Harbor (Segment 2484) August 8-14, 1982. The Corpus Christi Inner Harbor is a dredged, man-made, dead-end channel approximately 8.6 miles long. Since the study of August 10, 1973, water quality has improved which is attributed to reduced loading to the Inner Harbor from wastewater sources and removal of some contaminated sediments in the bottom of the harbor. Sediments are still contaminated with heavy metals, organics, and polychlorinated biphenyls. District 12 recommends that during future dredging of the Inner Harbor, dredged material be contained in leveed settling lagoons with decantation back to the Harbor. Water and sediment quality data were collected at 15 locations and from all known and permitted discharges to the Harbor. Benthic macroinvertebrate data were collected at six of the 15 locations. The levels of total organic carbon in the water ranged from < 5 mg/l to 6 mg/l. All laboratory pH analyses of the water samples were within the standards for Segment 2484 (6.5 to 9.0). Values of nutrients (phosphorus, ammonia, nitrates, and nitrites) at all survey stations were low. No pesticides were detected in the sediment. (Fazio-Omniplan)
W86-03440

POLYCHLORINATED BIPHENYLS (PCBS),
California State Water Resources Control Board, Sacramento. Toxic Substances Control Program.
For primary bibliographic entry see Field 5G.
W86-03446

RICE HERBICIDES: MOLINATE (ORDRAM) AND THIOBENCARB (BOLERO),
California State Water Resources Control Board, Sacramento. Toxic Substances Control Program.
For primary bibliographic entry see Field 5G.
W86-03447

CURRENTS IN SUISUN BAY,
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W86-03448

MANAGEMENT OF BOTTOM SEDIMENTS CONTAINING TOXIC SUSTANCES: PROCEEDINGS OF THE 8TH U.S./JAPAN EXPERTS MEETING,
Army Engineer Inst. for Water Resources, Fort Belvoir, VA.
For primary bibliographic entry see Field 5G.
W86-03461

STUDIES ON ANALYTICAL METHOD OF ACRYLAMIDE MONOMER AND ACCUMULATION INTO FISH,
Tsukuba Univ. (Japan). Inst. of Community Medicine.
M. Fujiki, J. Asada, and T. Shimizu.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 8th U.S./Japan Experts Meeting, November 8-10, 1982, Toyko, Japan. July 1984. p 147-166, 16 fig, 5 tab, 19 ref.

Descriptors: *Fate of pollutants, *Pollutant identification, *Fish, *Acrylamide, Carp, Killifish, Polymers, Accumulation, Bioaccumulation.

An analytical method was developed for acrylamide monomer to study its accumulation in fish. The fish tissue was analyzed as follows. After homogenization, the pH was adjusted to 1 with sulfuric acid. Potassium bromide and potassium bromate were added to the homogenate, which was then stored at 5 degrees C for 30 min. After bromination, the remaining bromine was removed by addition of sodium thiosulfate. The sample was then centrifuged to produce a supernatant containing dibromopropionamide. This derivative was extracted with ethyl acetate and measured by gas chromatography with electron capture detection. Fish were exposed for periods up to 40 days without feeding to 1 or 10 ppm of acrylamide monomer. At 1 ppm carp slowly accumulated the acrylamide monometer for 10 days. A maximum concentration of 0.26 ppm was reached on day 20. At the ppm level carp rapidly accumulated monomer for 10 days, slowly accumulated monomer until day 30, reaching a maximum of 7.65 ppm on day 40. Accumulation n killifish at 1 ppm monomer was similar to that of carp, reaching a maximum of 0.31 ppm on day 20. Killifish exposed to 10 ppm acrylamide monomer accumulated the chemical rapidly until day 15, then slowly until reaching a maximum of 25.3 ppm on day 20. Exposure of carp, killifish, and sea bream to 20 ppm of acrylamide polymer caused no detectable accumulation of acrylamide monomer. (Cassar-PTT)
W86-03466

ECO-KINETIC MODEL FOR THE ACCUMULATION OF PCB IN MARINE FISHES,
J. M. O'Connor, and J. C. Pizza.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 8th U.S./Japan Experts Meeting, November 8-10, 1982, Tokyo, Japan. July 1984. p 285-303, 9 fig, 4 tab, 33 ref.

Descriptors: *Fate of pollutants, *Polychlorinated biphenyls, *Fish, *Dredging, Accumulation, Bioaccumulation, New York Bight, Model studies, Sludge disposal, Ocean dumping, Food chains, Striped bass, Bass, Chlorinated hydrocarbons, Organic compounds.

Several conclusions were reached in a study of polychlorinated biphenyl (PCB) accumulation in fish. (1) The hypothesis that PCB in fishes is strongly related to diet renders the mass loading approach to ocean PCB pollution ineffective in estimating contaminant levels in fish. Both dredged material and sewage sludge must be evaluated more carefully to assess real quantities of PCBs injected into the food chain and the water column. (2) The pharmacodynamics of PCBs in fishes suggest that any isolation of contaminated materials from entry to the food chain will have the effect of lowering PCB body burdens in the large, predatory species which often form an important part of the human diet. Thus, maintaining a surficial layer of sediments with lower nonavailable PCBs will, in all likelihood, result in a trend toward lower body burdens in all trophic levels. (3) The overall outcome of the model suggests that we shall not see increased PCB levels in fishes if input rates and input sources remain similar to those of recent years. While we do not advocate use of the ocean as unrestricted dumps, we do suggest that, with time, the input of bioavailable PCB to New York marine waters has achieved a balance; it appears that any impacts which have occurred are not irreversible, although their description is unclear. Further dumping regulations should include attention to rendering such contaminants as PCB, first, unavailable to food chains, and finally, unavailable in the water column. (Author)
W86-03475

COMPARISON OF METHODS FOR ESTIMATING NUTRIENT RELEASE FROM LAKE SEDIMENTS,
M. Hosomi, M. Okada, and R. Sudo.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 8th U.S./Japan Experts Meeting, November 8-10, 1982, Tokyo, Japan. July 1984. p 238-250, 8 fig, 3 tab, 19 ref.

Descriptors: *Fate of pollutants, *Lake sediments, *Sediments, *Nutrients, Ammonium compounds, Nitrogen, Model studies, Mathematical models, Sediment cores, Interstitial water, Bottom sediments, Lake Yunoko, Japan, In situ chamber method, In situ sediment core method.

Four methods for estimating the rate of ammonium-N release from sediment are discussed. Precision of the ammonium-N release rate determination was compared by examining the variances among the laboratory sediment core method, the in situ sediment core method, the in situ chamber method, and the mathematical model method. The in situ core method reflected the least precision of the ammonium-N release rate determinations. Statistical tests showed that the ammonium-N release rates calculated from the ammonium-N gradient between the overlying water and the interstitial water of the 0- to 2-cm layer in the uppermost sediment did not significantly differ from those estimated by the laboratory core method and the in situ chamber method. The mathematical model calculating the ammonium-N gradient between the overlying water and the interstitial water in the uppermost layer of sediment could well be applied to other lake systems. (Author)
W86-03477

STOCHASTIC-CONVECTIVE ENSEMBLE METHOD FOR REPRESENTING DISPERSIVE TRANSPORT IN GROUNDWATER,
Battelle Pacific Northwest Labs., Richland, WA.
C. S. Simmons.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-021340, Price codes: A06 in paper copy, A01 in microfiche. EPRI-CS-2558, August 1982. Topical Report. 101 p, 4 fig, 18 ref, 5 append. 1406-1.

Descriptors: *Stochastic process, *Mathematical models, *Groundwater movement, *Leachates, *Solute transport, Mathematical studies, Landfills, Permeability coefficient, *Solute transport, Mathematical studies, Landfills, Permeability coefficient, Aquifers, Sand aquifers, Models, Model studies, Stochastic hydrology, Convection, Tracers, Fate of pollutants, Path of pollutants, Leaching.

A stochastic-convective transport model was developed to describe three-dimensional hydrodispersion of a non-reactive solute in groundwater. The model was based on the probability density function (Pdf) for an ensemble model of stochastic variation in flow velocity. Concepts of the method are demonstrated explicitly with a simple example tent-shaped Pdf. The method describes linear increase of effective dispersivity with solute travel distance, when velocity correlation is long-range. Previously derived results about macrodispersion in a stratified system are obtained with an ensemble viewpoint and are generalized for non-uniform velocity. A scale-relation description of hydraulic conductivity and hydraulic gradient random variations, was also developed to represent stochastic velocity. The model is based on a multiplicative rather than an additive stochastic process. It was

demonstrated that a covariance function for relative velocity variation is perhaps a better description of random variations in porous media. The model was applied to a small-scale tracer study performed near the Borden landfill, Waterloo, Ontario. An indirect evaluation of stochastic transport parameters was demonstrated for the sandy aquifer site. Results show a relatively small magnitude of velocity variation, but exhibit long-range correlations over at least a 4 m distance in both longitudinal and horizontally transverse directions. This is an example of non-Fickian dispersion, even though the solute distribution appears independently Gaussian for all principal directions. (Geiger-PTT)
W86-03498

TRANSPORT OF CONTAMINANTS FROM ENERGY PROCESS WASTE LEACHATES THROUGH SUBSURFACE SOILS AND SOIL COMPONENTS LABORATORY EXPERIMENTS,
Los Alamos National Lab., NM.
L. E. Wangen, E. A. Stallings, and R. D. Walker.
LA-9406-MS, August 1982. 39 p, 9 fig, 7 tab, 25 ref, 4 append.

Descriptors: *Leachates, *Waste disposal, *Soil types, *Adsorption, *Fate of pollutants, *Adsorbents, Clays, Clay loam, Sand, Arsenic, Boron, Selenium, Molybdenum, Cadmium, Nickel, Heavy metals, Anions, Cations, Path of pollutants, Clay minerals, Land disposal.

The subsurface transport and attenuation of inorganic contaminants common to a variety of energy process waste leachates are being studied using laboratory column methods. Anionic species currently being emphasized are As, B, Mo, and Se. Transport of the cations Cd and Ni is also being studied. The solid absorbents consist of three soil mineral components (silica sand, kaolinite, and goethite), and four subsurface soils (a dunal sand, an oxidic sandy clay loam, an acidic clay loam, and an alkaline clay loam). Breakthrough patterns of these species from packed soil columns are followed by monitoring eluent concentrations vs. time under carefully controlled laboratory conditions. The report describes the experimental methods being used, the results of preliminary batch adsorption studies, and the results of column experiments completed through calendar year 1981. Using column influent concentration of about 10 milligrams/liter, adsorption (millimoles/100 g) has been determined from the eluent volume corresponding to 50% breakthrough. On silica sand, kaolinite, dunal sand, and goethite, respectively, these are .0002, 0.020, 0.013, and 0.31 for Cd, .00044, 0.039, 0.020, and 0.98 for Ni. On kaolinite, dunal sand, and goethite, respectively, adsorption values (millimoles/100 g) are As (0.24, 0.019, and 20.5), B (0.041, 0.0019, and 1.77), Mo (0.048, 0.0010, and 5.93), and Se (0.029, 0.00048, and 1.30). Arsenic is the most highly adsorbed contaminant species and goethite has the largest adsorption capacity of the adsorbents. (Author)
W86-03500

DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN INDUSTRIAL DISCHARGES AND OTHER AQUEOUS EFFLUENTS,
Norsk Inst. for Vannforskning, Oslo.
For primary bibliographic entry see Field 5A.
W86-03506

GIARDIASIS IN WASHINGTON STATE,
Washington State Dept. of Social and Health Services, Olympia. Office of Environmental Health Programs.
For primary bibliographic entry see Field 5C.
W86-03507

CHARACTERISTICS AND TREATABILITY OF URBAN RUNOFF RESIDUALS,
Rexnord, Inc., Milwaukee, WI. Environmental Research Center.
D. J. Carr, A. Geinopolos, and A. E. Zanoni.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-133561, Price codes: A05 in paper copy, A01 in microfiche. EPA-600/2-82-094, November 1982. 83 p, 16 fig, 22 tab, 22 ref, 2 append. R-806785.

Descriptors: *Urban runoff, *Storm runoff, *Wastewater treatment, *Storm wastewater, *Separation techniques, Pollutant identification, Pesticides, Suspended solids, Land disposal, Heavy metals, Polychlorinated biphenyls, Nutrients, Organic compounds, Wastewater disposal, Dewatering, Centrifugation, Lime, Urban hydrology.

The study was undertaken to determine the character of urban stormwater runoff (UR) residuals as well as handling and disposal techniques. Samples of UR residuals for the study were obtained from a field-assembled sedimentation basin in Racine, WI, swirl and helical bend solids separators in Boston, MA, and an in-line upsized storm conduit in Lansing, MI. The characterization study included analyses for nine metals, eight pesticides and PCB's, solids, nutrients and organics. The treatability study included bench scale sedimentation tests, centrifugation tests, lime stabilization tests and capillary suction time tests. The total solids concentration of the residual samples obtained from the three sites varied from 233 to 161,000 mg/l. The concentration of nutrients (TKN, NH3, NO2, and NO3) varied from 0.3 to 2250 mg/l. Fe was found in the highest concentrations observed were those for Pb and Zn, respectively. PCB's were observed in measurable concentrations (0.19 to 24.6 micrograms/1). Of the eight pesticides surveyed, only three (DDT, DDD and Dieldrin) were found in measurable concentrations. Treatability data indicated that gravity thickening is a very effective means for dewatering UR residuals. Centrifugation was also found to be effective in thickening UR residuals. Stabilization using lime was recommended. Based upon the study results, the most cost-effective UR residuals handling and disposal method is gravity thickening followed by landfilling. (Author)
W86-03508

INSTRUMENTATION AND METHODS EVALUATIONS FOR SHALLOW LAND BURIAL OF WASTE MATERIALS: WATER EROSION,
Energy Resource Management, Tucson, AZ.
For primary bibliographic entry see Field 5E.
W86-03510

REPORT OF ANALYSES FOR LIGHT HYDROCARBONS IN GROUND WATER,
Du Pont de Nemours (E.I.) and Co., Aiken, SC. Savannah River Plant.
For primary bibliographic entry see Field 5A.
W86-03512

DETERMINATION OF CARBOHYDRATES AND PRIMARY AMINES IN RIVER WATER,
Minnesota Univ., Minneapolis. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W86-03524

ULTRAVIOLET MULTIWAVELENGTH ABSORBANCE MEASUREMENTS FOR MONITORING TRACE ORGANICS IN WATER,
Minnesota Univ., Minneapolis.
For primary bibliographic entry see Field 5A.
W86-03525

CHEMICAL AND MICROBIOLOGICAL MONITORING OF A SOLE-SOURCE AQUIFER INTENDED FOR ARTIFICIAL RECHARGE, NASSAU COUNTY, NEW YORK,
Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 5A.
W86-03527

POLLUTION IN SWIMMING POOL WATER,
Florida International Univ., Miami.
J. A. Beech.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 525-546, 12 fig, 3 tab, 36 ref.

Descriptors: *Fate of pollutants, *Water pollution sources, *Swimming pools, Organic compounds, Chlorinated hydrocarbons, Trihalomethanes, Metals, Heavy metals, Nitrates, Hydrogen ion concentrations, Chlorate.

Swimming pool water in Dade County, Florida, was analyzed for levels of various pollutants. Trihalomethanes, derived from chlorination of organic precursors such as plant and animal detritus, were present at concentrations as high as 367 micrograms per liter, chloroform predominating over bromodichloromethane, chlorodibromomethane, and bromoform. Pool sediments were leached at pH from zero to about 9. For the heavy metals (lead, copper, cadmium, iron, manganese) equilibrium leaching curves were produced. Cadmium and iron curves were similar for sediments from all six pools. However, the amount of lead, copper, and manganese varied greatly for different sediments. Estimated nitrate concentration at the end of the 14-week swimming season was 27 mg per liter, assuming a 500,000-liter pool, 2000 swimmers per week, and a 30% loss from splashout and backwashing. Most pools had chlorate concentrations of less than 20 mg per liter; the highest level was 124 mg per liter. Alkaline pool water favored formation of trihalomethanes and nitrates; acid pool water favored formation of chlorates and solubilization of heavy metals.
W86-03544

EVALUATION OF FUTURE BASE-FLOW WATER-QUALITY CONDITIONS IN THE HILLSBOROUGH RIVER, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. Fernandez, C. L. Goetz, and J. E. Miller.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4182, 1984. 47 p, 16 fig, 12 tab, 25 ref.

Descriptors: *Computer models, *River forecasting, *Pollution(Stream), *Watershed management, Storm runoff, *Urbanization, One-dimensional model, Steady-state model, Water quality, Urban runoff, Base flow, Coliforms, *Florida.

A one-dimensional, steady-state, water-quality model was developed for a 30.0 mile reach of the Hillsborough River to evaluate water-quality conditions to be expected from future development. The model was calibrated and verified using data collected under critical base-flow conditions in April and December 1978. Dissolved organic nitrogen, nitrate nitrogen, and total and fecal coliforms were modeled for most of the study reach. Model results were used to evaluate the impacts of two typical housing developments on water-quality conditions in Tampa Reservoir. One development is located in the Cypress Creek basin and the other near the upper end of the study reach. Model results show development in the Hillsborough River basin may cause increased total and fecal coliform conditions. Simulated total coliforms at the Tampa water treatment plant for 1-, 3-, and 5-square-mile developments located in the Cypress Creek basin were 3,000, 5,400, and 8,300 colonies per 100 milliliters. Similar developments, however, located near the upper end of the study reach were 2,000, 3,600, and 5,100 colonies per 100 milliliters. Simulated fecal coliforms were 360, 700, and 100 and 180, 350, and 510 colonies per 100 milliliters, respectively. Other constituents modeled showed only minor increases in concentrations. (USGS)
W86-03546

CHEMICAL QUALITY OF LANDFILL LEACHATE IN TREATMENT PONDS AND MIGRATION OF LEACHATE IN THE SURFICIAL AQUIFER, PINELLAS COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. Fernandez, and G. L. Barr.
Available from OFSS, USGS, Box 25425 Lakewood, CO 80225. USGS Water-Resources Investigation Report 83-4193, 1984. 52 p, 22 fig, 5 tab, 24 ref.

Descriptors: *Landfills, *Lagoons, Water quality, *Groundwater movement, Wastewater treatment, Path of pollutants, *Florida, *Landfill leachate, Leachate movement, Ammonia nitrogen, Potassium.

The Pinellas County leachate treatment and disposal site encompasses about 8 acres within the 220 acres of the county's Bridgeway Acres landfill. The site has a high water table and is subject to inundation due to tidal flooding and major storms. Fresh leachate is pumped from V-shaped trenches an average of about 3.8 hours per day. The pumping rate ranges from 150 to 500 gallons per minute. The leachate is aerated for about 2 days in a lined basin, then transferred by gravity to a stabilization pond where it is permitted to infiltrate into the surficial aquifer. Two chemical constituents, ammonia nitrogen and potassium, were used as indicators of migration of the leachate in the aquifer. No apparent nitrification occurred within the treatment system. Leachate has migrated from about 75 to 80 feet along the upper 5 feet of the aquifer during the period of study. Vertical migration was about 4 feet beneath the bottom of the pond into the aquifer. (USGS)
W86-03549

HYDROLOGY AND LAND USE IN VAN BUREN COUNTY, MICHIGAN,
Geological Survey, Lansing, MI. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03554

RESULTS OF A SOLUTE TRANSPORT EXPERIMENT AT UVAS CREEK, SEPTEMBER 1972,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W86-03556

OCCURRENCE AND DISTRIBUTION OF FLUORIDE IN GROUNDWATERS OF KENYA,
Nairobi Univ. (Kenya). Dept. of Dental Surgery.
For primary bibliographic entry see Field 2K.
W86-03569

ENVIRONMENTAL ISOTOPE HYDROLOGY IN SOUTHERN AFRICA,
University of the Witwatersrand, Johannesburg (South Africa).
For primary bibliographic entry see Field 2F.
W86-03576

PERFORMANCE OF SANITARY COMPLETION MEASURES OF WELLS AND BOREHOLES USED FOR RURAL WATER SUPPLIES IN MALAWI,
Department of Lands, Valuation and Water, Lilongwe (Malawi).
For primary bibliographic entry see Field 5G.
W86-03582

ONSHORE IMPACTS OF OFFSHORE HYDROCARBON DEVELOPMENT: ANNOTATED BIBLIOGRAPHY,
Environmental Protection Service, Ottawa (Ontario).
For primary bibliographic entry see Field 5C.
W86-03620

CANADIAN INLAND WATERS: COASTAL ENVIRONMENTS AND THE CLEANUP OF OIL SPILLS,
Woodward-Clyde Consultants, Victoria (British Columbia).
For primary bibliographic entry see Field 5G.
W86-03621

LITERATURE SURVEY OF RESERVOIR CONTAMINANT PROBLEMS,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
R. A. Khalid, R. P. Gambrell, B. A. Taylor, and W. H. Patrick.
Technical Report E-83-13, May 1983. Final Report. U.S. Army Environmental and Water Quality Operational Studies, Army Engineering Waterways Experiment Station, Vicksburg, MS. 159 p, 22 tab, 221 ref, 2 append. DACW39-80-C-0032

Descriptors: *Reservoirs, Aquatic life, Chemicals, *Fate of pollutants, Sediment transport, *Water quality, *Water quality standards, *Pollution load, Literature review, Reservoir operation, Corps of Engineers, Fish, Shellfish, Sampling, Biological magnification, Standards, Metals, Organic compounds, Inorganic compounds, Pollutant identification, Salinity, Data aquisition, Water analysis, Sedimentation, Sediment discharge, Sediment load, Bottom sediments, Monitoring, Stratification, Trace elements, Pesticides, Insecticides, Herbicides, Water pollution control, Acid mine drainage.

The literature on toxic chemical contaminants in Corps of Engineers reservoirs is reviewed for the purpose of developing interim guidelines to minimize contaminant problems. Sources of information include the published literature, the EPA STORET system, Corps of Engineers personnel, and other government reports. Although a considerable amount of information is available, procedures vary widely and certain subject areas have limited data. The need for basic project-specific research on the chemistry and fate of toxic contaminants in reservoir systems is emphasized. Data on inorganic contaminants were limited, but data on organic contaminants were even mrre limited. Only a few selected reservoirs were intensively monitored. Regional patterns of contamination were not established except for some patterns in acid mine discharge and high salinity. Limited information was available on sediment loss from watersheds, sediment transport in streams and rivers, sedimentation in reservoirs, sediment discharge in reservoir releases, and contaminant loadings of reservoirs and release waters. Very little information is available on which to base guidelines for managing reservoir contamination.
W86-03623

USER'S MANUAL FOR THE INSTREAM SEDIMENT-CONTAMINANT TRANSPORT MODEL SERATRA,
Battelle Pacific Northwest Labs., Richland, WA.
Y. Onishi, and S. E. Wise.
EPA 600/3-82-055, May 1982. Environmental Research Laboratory, Athens, GA. 187 p, 1 fig, 6 tab, 7 ref, append. 68-03-2613.

Descriptors: *Sediment transport, *Model studies, *Mathematical models, *Mathematical equations, *Fate of pollutants, *Pesticide kinetics, *Computer programs, *Finite element method, Models, Path of pollutants, Prediction.

This manual guides the user in applying the sediment-contaminant transport model SERATRA which is an integral part of the Chemical Migration and Risk Assessment Methodology. SERATRA is an unsteady two-dimensional code that utilizes the finite element computation method with the Galerkin weighted residual technique. It predicts overland and instream pesticide migration and fate to assess the potential short- and long-term impacts on aquatic biota in receiving streams. The model has general convection-diffusion equations containing decay and sink/source terms with appropriate boundary conditions. A sediment transport submodel, a dissolved contaminant transport submodel, and a particulate contaminant (adsorbed by sediment) transport submodel are coupled to include the effects of sediment-contaminant interaction.
W86-03630

FATE OF OIL AND DISPERSANT MIXTURES IN FRESHWATER,
Canada Centre for Inland Waters, Burlington (Ontario).
E. Nagy, B. F. Scott, and J. Hart.
Report EPA 4-EC-81-3, December 1981. Environmental Protection Service, Ottawa, Ontario. 66 p, 21 fig, 6 tab, 15 ref, 4 append.

Descriptors: *Fate of pollutants, *Path of pollutants, *Dispersants, *Oil spills, *Oil slicks, *Cleanup operations, Surfactants, Ponds, Recovery, Toxicity, Chemical analysis.

The study was initiated to observe the fate and ecological effect of an oil/dispersant mixture in a selected freshwater system over an extended period of time. Also, the effectiveness of the dispersant under the test conditions and the ability of the system to recover, if adversely affected, were investigated. Large outdoor ponds with their indigenous biota were utilized, and results from ponds treated with an oil/dispersant mixture were compared to those from oil-treated and control ponds. Oiled and controlled conditions were established, using Norman Wells crude oil and Corexit 9527 as the dispersant. The surface, water column, sediment, liner and attached biota were sampled systematically for a year. The water column contained only a small amount of the oil during most of the experimental period, as dispersed oil quickly surfaced and eventually sank to the sediment. The chemistry and composition of the slicks were examined; thinner slicks had a greater carbonyl content and more dispersant relative to thicker slicks. Final distribution analysis revealed that more oil was unaccounted for in the oil/dispersant ponds than in the oil-treated pond. There was no evidence to suggest that the dispersant altered the composition of the oil during the experiment, and the oil in all ponds underwent changes that were similarly independent of treatment.
W86-03637

DEEP-WATER BLOWOUT TRAJECTORY MODELS FOR THE LANCASTER SOUND REGION,
Arctic Sciences Ltd., Sidney (British Columbia).
J. R. Marko.
Report EPS 4-EC-82-2, March 1982. Environmental Protection Service, Ottawa, Ontario. 134 p, 19 fig, 7 tab, 24 ref, 2 append.

Descriptors: *Path of pollutants, *Blowouts, *Deep water, *Trajectory models, *Oil spills, *Turbulent flow, Model studies, Wind, Wind tides, Baffin Bay, Lancaster Sound.

Procedures were developed to simulate sea surface movements of oil released from deep-water oil blowouts. Emphasis was upon making realistic allowances for the horizontal spreading of oil by turbulence and current-features not included in the 5 nautical mile grid of residual currents utilized. The current values in this grid were established through the use of recent data from moored current-meters and drift-buoys. Simulations were carried out for four hypothetical blowout locations in Lancaster Sound and in the immediately adjoining sector of Baffin Bay. Separate scenarios were calculated at each site for steady winds from each of the four basic directions and for actual recorded wind sequences. Considerable contamination of shorelines occurred in most cases, except under westerly winds which generally tended to sweep oil out into the more open Baffin Bay region. Uncertainties regarding the appropriate magnitude of horizontal diffusion were explored through comparisons of scenarios computed for different values of a basic diffusivity parameter.
W86-03638

EVALUATION OF SELECTED ONE-DIMENSIONAL STREAM WATER-QUALITY MODELS WITH FIELD DATA,
Geological Survey, NSTL Station, MS. Gulf Coast Hydroscience Center.
S. C. McCutcheon.
Technical Report E-83-11, May 1983. Final Report. U.S. Army Environmental and Water Quality Operational Studies, Army Engineer Waterways Experiment Station, Vicksburg, MS. 183 p, 40 fig, 14 tab, 55 ref, append.

Descriptors: *Reservoirs, *Rivers, *Model studies, *Water quality, *Fate of pollutants, *Nitrogen

compounds, Mathematical models, Chattahoochee River, Georgia, Willamette River, Oregon, Arkansas River, Colorado, Streeter-Phelps model, QUAL II model, U.S. Geological Survey model, U.S. Army Hydrologic Engineering Center model, Velz model, Massachusetts Institute of Technology model, Nitrification, Dissolved oxygen, Orthophosphates, Phosphates, Coliforms, Water pollution, Metals, Water temperature, Bacteria, Biochemical oxygen demand, Algae, Nitrates, Ammonia, Stream biota, Aeration, Ecology, Phytoplankton, Zooplankton, Temperature.

Evaluation of the U.S. Geological Survey One-Dimensional Steady-State Stream Water-Quality Model (a modified Streeter-Phelps model), the QUAL II model (Southeast Michigan Council of Governments version), and the U.S. Army Hydrologic Engineering Center's Water Quality for River-Reservoir Systems model indicate that these readily available models for simulating water quality downstream of reservoirs were of comparable accuracy and performance and performed according to their documentation. The evaluation was based on a wide range of accurate steady-state data collected on the Chattahoochee River in Georgia, the Willamette River in Oregon, and the Arkansas River in Colorado. A number of differences exist among these three models; however, each model has the flexibility to make these differences relatively unimportant for typical water quality studies. Each model had minor coding errors which have been corrected. Modeling capabilities are summarized in tabular form to facilitate comparison and selection. Although the modified Streeter-Phelps and QUAL II models are equally valid, different modeling options may make one preferable depending on the specific modeling application. The Water Quality for River-Reservoir Systems model is best limited to dynamic flow and water quality modeling because the data-coding it requires is tedious and involved. However, the wide range of components in the model may be needed for steady-state modeling under special conditions. (Author)
W86-03644

MATHEMATICAL MODEL, SERATRA, FOR SEDIMENT-CONTAMINANT TRANSPORT IN RIVERS AND ITS APPLICATION TO PESTICIDE TRANSPORT IN FOUR MILE AND WOLF CREEKS IN IOWA,
Battelle Pacific Northwest Labs., Richland, WA.
Y. Onishi, and S. E. Wise.
EPA 600/3-82-045, August 1982. Environmental Research Laboratory, Athens, GA. 56 p, 24 fig, 26 ref. 68-03-2613.

Descriptors: *Sediment transport, *Simulation analysis, *Pesticide kinetics, *Fate of pollutants, *Mathematical models, *Hydrolysis, *Chemical degradation, *Halogenated pesticides, Models, Model studies, Pesticides, Water pollution effects, Aquatic life, Path of pollutants, Water pollution sources, Biodegradation, Oxidation.

The sediment-contaminant transport model SERATRA was used as an integral part of the Chemical Migration and Risk Assessment Methodology, which simulates migration and fate of a contaminant over the land surface and in receiving streams, to assess potential short- and long-term impact on aquatic biota. SERATRA, an unsteady, two-dimensional finite element model, consists of three submodels coupled to include the effects of sediment-contaminant interactions--a sediment transport submodel, a dissolved contaminant transport submodel, and a particulate contaminant (contaminants adsorbed by sediment) transport submodel. The sediment transport submodel simulates transport, deposition and scouring of three sediment size fractions of cohesive and noncohesive sediments. The dissolved contaminant transport submodel includes mechanisms of contaminant adsorption/desorption and contaminant degradation resulting from hydrolysis, oxidation, photolysis, volatilization, biological activities and radionuclide decay to predict migration of dissolved contaminant. The particulate contaminant submodel simulates transport, deposition and scouring of contaminants associated with three size fractions of sediments. SERATRA also predicts changes of bed conditions for sediment and particulate contaminants. SERATRA was applied to Four Mile and Wolf Creeks in Iowa to simulate transport of sediment and the pesticide alachlor in these streams. Study results demonstrate that SERATRA is a useful tool for evaluating migration and fate of various hazardous substances and toxic chemicals in rivers by including contaminant interaction and contaminant degradation. (Author)
W86-03648

NONPOINT NITRATE POLLUTION OF MUNICIPAL WATER SUPPLY SOURCES: ISSUES OF ANALYSIS AND CONTROL,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 5G.
W86-03649

EFFECTS OF REGIONAL WATER MANAGEMENT ON N-POLLUTION IN AREAS WITH INTENSIVE AGRICULTURE,
Instituut voor Cultuurtechniek en Waterhuishouding, Wageningen (Netherlands).
For primary bibliographic entry see Field 5G.
W86-03650

HYDROGEOLOGICAL ASPECTS OF GROUNDWATER NITRIFICATION,
L. Alfoldi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-119222, Price codes: A02 in paper copy, A01 in microfiche. In: Nonpoint Nitrate Pollution of Municipal Water Supply Sources: Issues of Analysis and Control, Proceedings of an IIASA Task Force Meeting, February 10-12, 1982, Laxenburg, Austria. Series No. CP-82-S4, 1982. p 43-55, 6 fig, 4 ref.

Descriptors: *Nitrates, *Nonpoint pollution sources, *Agriculture, *Water quality control, *Fate of pollutants, *Subsurface water, Fertilizers, Soil chemistry, Nitrogen compounds, Capillarity, Nitrification, Ammonia, Groundwater pollution, Confined aquifers, Surface water, Hydrologic budget, Water pollution sources, Soil horizons, Soil profiles, Soil water.

Surface and subsurface waters constitute two separate systems with respect to nitrogen budget. Interaction bewteen the two can be characterized by simple input-output relationships. The accumulation of nitrogen in subsurface waters is the result of complex and intermittent processes. Organic matter and nitrogen fertilizers enter the soil, where biochemical and chemical reactions transform the nitrogen compounds to ammonia and nitrate depending on pH and temperature. Soil systems can be classified hydrogeologically into three types: (1) self-contained water budget, as seen in gravel underlying surface soil (nitrates tend to accumulate), water budget affected by subsurface waters (nitrate permeates deep zones), and independent water budgets, e.g., impervious clay separating the surface and underlying aquifer (little vertical nitrate pollution). An understanding of the three basic soil systems shows how nitrate can accumulate irreversibly in groundwater and highlights the necessity of better control of fertilizer application.
W86-03651

IMPACT OF NITROGEN FERTILIZER APPLICATION ON THE NITRATE CONCENTRATION IN GROUNDWATER: COST-BENEFIT ANALYSIS CONSIDERATIONS,
Goettingen Univ. (Germany, F.R.).
For primary bibliographic entry see Field 5G.
W86-03652

POSSIBILITIES OF CONTROLLING NITRATE CONCENTRATIONS IN DRINKING WATER,
For primary bibliographic entry see Field 5G.
W86-03653

NITRATE POLLUTION OF GROUNDWATER RESOURCES: MECHANISMS AND MODELLING,
Water Research Centre, Medmenham (England). Medmenham Lab.
D. B. Oakes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-119222, Price codes: A02 in paper copy, A01 in microfiche. In: Nonpoint Nitrate Pollution of Municipal Water Supply Sources: Issues of Analysis and Control, Proceedings of an IIASA Task Force Meeting, February 10-12, 1982, Laxenburg, Austria, Series No. CP-82-S4, 1982. p 207-230, 13 fig, 2 tab, 15 ref.

Descriptors: *Path of pollutants, *Nitrates, *Groundwater pollution, *Model studies, *Aquifers, *Solute transport, *Nonpoint pollution sources, Interstitial water, Aquifers, Chalk Aquifer, United Kingdom, Water pollution sources, Agriculture, Nitrogen compounds, Aeration zone, Grasslands.

In the United Kingdom field studies of the unsaturated zones of 30 sites on the Chalk and 12 on the Triassic Sandstone aquifers have shown a correlation between arable farming regimes and high nitrate concentrations in interstitial pore water. A slow downward movement of nitrate has been proved at three sites. A mathematical model of solute transport through the unsaturated zone has successfully simulated the observed nitrate profiles at a number of the investigated sites. This vertical transport model has been incorporated in a catchment model which has been used to predict changes in ground water nitrates, in some areas, to levels above 11.3 mg N per liter. (Author)
W86-03656

INTEGRATED PHYSICAL-ECONOMIC SYSTEMS ANALYSIS OF IRRIGATED AGRICULTURE,
California Univ., Davis. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 5G.
W86-03658

AQUACULTURE AND DREDGED MATERIAL CONTAINMENT SITES: SIGNIFICANCE OF CONTAMINATED SEDIMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
H. E. Tatem.
In: Aquaculture in Dredged Material Containment Areas: Proceedings, September 1982, Galveston, TX. Miscellaneous Paper D-83-2, October 1983. p 169-189, 15 tab, 1 fig, 18 ref.

Descriptors: *Fate of pollutants, *Ponds, *Aquaculture, *Aquatic habitats, *Dredging, *Sediments, *Invertebrates, Clams, Polychlorinated biphenyls, Chlorinated hydrocarbons, Metals, Lead, Prawns, Bioaccumulation, Accumulation, Polychaetes, Aquatic animals.

Invertebrates were exposed to contaminated sediments for periods of 30 to 136 days. Polychlorinated biphenyls (PCBs) were available to animals, particularly to infaunal species. Bioaccumulation was affected by the level of contamination, organic material in the sediment, and the life-style of the organism. Animals did not concentrate PCBs to levels greater than sediment levels. Shrimp and filter-feeding clams did not accumulate as much PCBs as polychaetes or deposit-feeding clams. Of the metals considered, only lead showed potential for bioaccumulation. Levels of lead in the animals were much lower than levels in the sediments. Although most dredged material contains PCB, deposition in containment areas can be planned so that sediment with higher concentrations of PCB are covered with less contaminated sediments.
W86-03714

PHYTOPLANKTON-ENVIRONMENTAL INTERACTIONS IN RESERVOIRS: VOLUME 1.
For primary bibliographic entry see Field 2H.
W86-03716

CONTAMINANTS IN THE UPPER MISSISSIPPI RIVER: PROCEEDINGS OF THE 15TH ANNUAL MEETING OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM.
For primary bibliographic entry see Field 6G.
W86-03737

DISTRIBUTION AND ENRICHMENT OF TRACE METALS (CD, CR, CU, NI, PB, ZN) IN BOTTOM SEDIMENTS OF NAVIGATION POOLS 4 (LAKE PEPIN), 5 AND 9 OF THE UPPER MISSISSIPPI RIVER,
Wisconsin Univ.-La Crosse. River Studies Center.
P. A. Bailey, and R. G. Rada.
In: Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium, Butterworth, Boston. 1984. p 119-138, 6 fig, 5 tab, 28 ref.

Descriptors: *Fate of pollutants, *Metals, Rivers, *Sediments, Bottom sediments, Lake sediments, Heavy metals, Cadmium, Chromium, Copper, Nickel, Lead, Zinc, Adsorption, Clay, Organic matter, Mississippi River, Lake Pepin, Backwater.

Bed sediments were collected in Lake Pepin in the Upper Mississippi Valley, to determine the heavy metals contents and physical parameters. Strong positive correlations were obtained between metals and clay, between metals and organic matter, and between clay and organic matter. Lake Pepin, which contains a high proportion of clay, apparently acts as a trapping basin for metals. Mean metals concentrations (in micrograms per gram dry weight), when adjusted for grain size effects and grain size distributions, were as follows: in Lake Pepin and above Lake Pepin--Cd, 2.68-3.44; Cr, 33.1-39.9; Cu, 20.8-21.8; Ni, 22.1-21.8; Pb, 22.1-23.0; and Zn, 81.8-95.9; downstream of Lake Pepin--Cd, 1.27-1.29; Cr, 20.0-26.3; Cu, 13.4-15.3; Ni, 10.3-21.9; Pb, 12.8-16.7; and Zn, 56.9-57.5. Comparison of the data show that cadmium, copper, lead, and zinc levels were significantly higher within and upstream of Lake Pepin than in downstream stations. Chromium levels showed a slight trend in this direction. However, nickel levels were similar upstream and within Lake Pepin and at the closest downstream station.
W86-03742

LONGITUDINAL DISTRIBUTION OF TRACE ELEMENTS (AS, CD, CR, HG, PB, AND SE) IN FISHES AND SEDIMENTS IN THE UPPER MISSISSIPPI RIVER,
Columbia National Fisheries Research Lab., La Crosse, WI. Field Research Station.
J. G. Wiener, G. A. Jackson, T. W. May, and B. P. Cole.
In: Contaminants in the Upper Mississippi River; Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium, Butterworth, Boston. 1984. p 139-170, 1 fig, 9 tab, 67 ref.

Descriptors: *Fate of pollutants, Fish, *Metals, Rivers, *Sediments, *Accumulation, Backwater, Bed sediments, Heavy metals, Cadmium, Mercury, Lead, Arsenic, Selenium, Chromium, Carp, Bluegills, Mississippi River, Bioaccumulation.

Concentrations of trace metals were determined in bed sediments and fish from a 500-km stretch of the Upper Mississippi River from upstream of the Twin Cities area to Guttenberg, Iowa. Levels of trace elements were generally highest in whole carp and carp liver from samples collected upstream from, at, and immediately downstream from the Twin Cities area. However, the metals levels in whole bluegills and common carp generally showed no correlation. Concentrations of Cd, Hg, and Pb in bed sediments at and downstream from the Twin Cities were higher than samples from other sites. Spearman correlation coefficients between elemental concentrations in fish and in bed sediments, paired by location, were nonsignificant for As, Cd, and Hg and only marginally significant for Pb. Mean concentrations (in micrograms per g dry weight) for whole fish were as follows: carp--As, 0.35; Cd, 0.11; Cr, 0.40; Pb, 2.9; Hg, 0.45; Se, 0.99; bluegill--As, 0.29; Cd, 0.046; Cr, 3.5; Pb, 0.38; Hg, 0.20; Se, 1.2. Concentrations of metals in sediments varied with the location; highest levels (in micrograms per g) were: Cd, 15.1; As, 6.24; Hg, 0.198; Pb, 85.8.
W86-03743

HEAVY METAL ACCUMULATION IN SELECTED SESSILE COMPONENTS OF FOUNTAIN CITY BAY, POOL 5A, OF THE UPPER MISSISSIPPI RIVER,
Saint Mary's Coll., Winona, MN. Dept. of Biology.
K. J. Buhl, and D. R. McConville.
In: Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium, Butterworth, Boston. 1984. p 171-194, 3 fig, 8 tab, 43 ref.

Descriptors: *Fate of pollutants, *Aquatic plants, *Metals, Rivers, *Accumulation, *Sediments, Mississippi River, Heavy metals, Bed sediments, Fountain Clay Bay, Backwater, Roots, Bioaccumulation, Macrophytes, Cadmium, Copper, Chromium, Zinc, Coontail, Pondweed, Water lily, Arrowhead.

The trace metals Cd, Cu, Cr, and Zn were differently accumulated by different ecological life forms of aquatic macrophytes. In addition, these metals were compartmentalized within rooted species. Broadleaf arrowhead roots accumulated significantly higher levels of Cd, Cr, Cu, and Zn than shoot tissues, whereas white water lily shoots contained significantly higher levels of Cd, Cr, and Zn than rhizomes. Copper was statistically higher in the rhizomes of water lilies than in shoots. The geographic distribution and accumulation of heavy metals in sediments of backwater areas along the Upper Mississippi River appear to be regulated by the transport and deposition of suspended solids (the fraction less than 63 microns), as demonstrated by the strong correlation obtained when total sediment metal concentrations were regressed against textural composition. Fine-grained sediments, which aggregate in backwater areas, act as metal sinks in the river. In relation to these sinks, coontail and Potamogeton may accumulate metals in the water column, whereas arrowhead roots may act as biological reservoirs in the bed sediments, mobilizing the particulate-bound metals. (Author)
W86-03744

TRACE ELEMENTS IN THE WATER, SEDIMENTS, AND FISH OF THE UPPER MISSISSIPPI RIVER, TWIN CITIES METROPOLITAN AREA,
Metropolitan Waste Control Commission, St. Paul, MN.
H. A. Boyer.
In: Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium, Butterworth, Boston. 1984. p 195-230, 2 fig, 16 tab, 45 ref.

Descriptors: *Fate of pollutants, Rivers, *Metals, *Aquatic life, Heavy metals, Trace metals, Sediments, Bed sediments, Fish, Water analysis, Mississippi River, Cadmium, Mercury, Lead, Arsenic, Copper, Zinc, Silver, Chromium, Nickel, Bioaccumulation, Accumulation, Public health.

Concentrations of trace elements in water, bed sediments, and fish of the Upper Mississippi River suggested potential impact on aquatic life and public health from cadmium, mercury, and lead; impact in public health only from arsenic; and impact on aquatic life only from copper and zinc. Trace element concentrations were of the same order of magnitude in the Twin Cities region as in the Lower St. Croix River, a tributary. Trends in concentrations of all trace elements were as follows: water--no discernible trends; sediment--increased from upstream to downstream, except for arsenic; fish--increased cadmium over most of the study area. Concentrations of Cd, Hg, Cu, and Zn in fish livers and bed sediments generally were within a factor of ten. As and Pb concentrations were less in carp livers than in bed sediments but more than in water. Pb and Zn levels in fish did not increase substantially with increases in bed sediment levels. Arsenic levels were higher in fish at some sites compared with levels in bed sediments. Selenium and beryllium levels were generally below detection. Silver, chromium, and nickel levels were considered of minor importance in this area of the river.
W86-03745

POLYCHLORINATED BIPHENYLS (PCBS) IN COMMON CARP (CYPRINUS CARPIO) OF THE UPPER MISSISSIPPI RIVER,
Minnesota Pollution Control Agency, Roseville.
M. E. Hora.
In: Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium, Butterworth, Boston. 1984. p 231-239, 3 fig, 4 tab, 6 ref.

Descriptors: *Fate of pollutants, *Polychlorinated biphenyls, Fish, Rivers, Mississippi River, *Carp, Chlorinated hydrocarbons, Minnesota River, Bioaccumulation, Accumulation, Aquatic life.

The grand weighted mean concentrations of polychlorinated biphenyls (PCB) in common carp fillet sampled in the Upper Mississippi River (Sartell to Wabasha) decreased 49% (from 4.01 mg/kg in 1975-76 to 2.05 mg/kg in 1979-80). The grand weighted mean of the lipid-based PCB concentrations decreased 65% in the same period (129 mg/kg to 45.1 mg/kg). PCB levels in carp also decreased 85% (3.24 mg/kg to 0.5 mg/kg) in the Minnesota River, a tributary of the Mississippi. These results should be compared with caution because of interlaboratory analytical differences between the earlier and later analyses.
W86-03746

POLYCHLORINATED BIPHENYLS AND ORGANOCHLORINE INSECTICIDES IN GREAT BLUE HERON AND GREAT EGRET EGGS FROM THE UPPER MISSISSIPPI RIVER,
Saint Mary's Coll., Winona, MN.
J. A. Nosek, and R. A. Faber.
In: Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium, Butterworth, Boston. 1984. p 241-259, 5 tab, 33 ref.

Descriptors: *Fate of pollutants, *Polychlorinated biphenyls, Birds, Rivers, *Wildlife, *Pesticides, *Aquatic animals, *Egrets, Herons, Eggs, Chlorinated hydrocarbons, Insecticides, DDT, DDE, Mirex, Heptachlor, Nonachlor, Hexachlorobenzene, Endrin, Dieldrin, Bioaccumulation, Accumulation, Waterfowl, Mississippi River, Fountain City Bay.

Eggs of great blue herons and great egrets collected in 1978 from a colony in the Fountain City Bay area of the Upper Mississippi River were analyzed for polychlorinated biphenyls (PCBs) and organochlorine pesticides. The highest concentrations found were those of PCBs, with geometric means of 14.1 and 13.3 ppm wet weight in great blue heron and great egret eggs, respectively. DDE concentrations were second highest, with geometric means of 1.41 and 1.76 ppm wet weight in heron and egret eggs, respectively. Ratios of (DDT+DDD)/DDE were higher than expected, because DDT was banned in 1972 (six years prior to the study), and it slowly degrades to DDE. Mirex was detected in 15 of the 22 eggs analyzed and probably was carried to the breeding area from the wintering grounds. The presence of endrin in seven of these specimens supports this contention. Dieldrin levels were higher than might be expected (geometric means of 0.400 and 0.391 ppm in herons and egrets, respectively), because it was banned in 1974. Also encountered were HCB, heptachlor epoxide, and trans-nonachlor. Reproductive success in 1978 was within the bounds of other published data, but colony size in 1978 was smaller than in 1975 (463 nests vs 586 nests). This decline was apparently due to movement of many birds to a new colony 16 km distant. (Author)
W86-03747

ESTABLISHMENT OF AN AMMONIA EFFLUENT LIMITATION FOR THE TWIN CITIES METRO PLANT,
Minnesota Pollution Control Agency, Roseville.

D. E. Maschwitz.
In: Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium, Butterworth, Boston. 1984. p 261-277, 2 fig, 9 tab, 13 ref.

Descriptors: *Fate of pollutants, *Water pollution sources, *Ammonia, *Wastewater treatment, *Standards, *Effluent limitations, Rivers, Mississippi River, Minnesota, Twin Cities, Low flow, Water quality standards.

Ammonia effluent limitations were determined for the Twin Cities Metro Plant using a mass balance calculation after ambient conditions below the discharger had been established. Past routine water quality data (1971-1979) from stations in the 10-mile reach of Mississippi River below the Metro Plant indicated a median pH value of 7.8 and a mean temperature of 24 degrees C for the critical period of July, August, and September. Routine data for 1980 and 1981 indicated a slight increase in downstream pH to 7.9, which generally coincided with improved BOD removal at the Metro Plant. The August through mid-September period combines relatively warm water temperatures (23 degrees C) with a greater probability of low flows. Thus, a pH of 7.9 and temperature of 23 degrees C formed the basis for the effluent limitation of 5 mg/liter for the critical period. Two provisions of Minnesota Water Quality Rules imply that compliance with the ammonia water quality standard will be achieved 50% of the time at the 7Q10 flow. A compliance analysis procedure was used to estimate compliance at flows other than the 7Q10 and over the full range of river flows. The procedure was based on the downstream variability of unionized ammonia and used the normal cumulative distribution to calculate the expected percent of time the standard will be exceeded. This technique can be a useful tool for assessing expected compliance with water quality standards under conditions of proposed limitations. (Author)
W86-03748

WATER CHEMISTRY AT SELECTED SITES ON POOLS 7 AND 8 OF THE UPPER MISSISSIPPI RIVER: A TEN-YEAR SURVEY,
National Fishery Research Lab., La Crosse, WI.
V. K. Dawson, G. A. Jackson, and C. E. Korschgen.
In: Contaminants in the Upper Mississippi River: Proceedings of the 15th annual Meeting of the Mississippi River Research Consortium, Butterworth, Boston. 1984. p 279-298, 3 fig, 2 tab, 7 append, 19 ref.

Descriptors: *Fate of pollutants, *Water quality, Rivers, Mississippi River, Nutrients, *Nitrogen compounds, Nitrates, Nitrites, Ammonia, Phosphates, Biochemical oxygen demand, Hydrogen ion concentration, Conductivity, Alkalinity, Water hardness, Dissolved oxygen, Oxygen, Water temperature, Suspended load, Seasonal variation, Varied flow, Runoff, *Water chemistry.

Water samples were collected from seven stations on the Upper Mississippi River from above Dakota to LaCrosse, Wisconsin. Results of 12 water quality parameters were averaged for each month over a ten-year period. Water chemistry appeared to depend on variations in river discharge rates. In summer, total phosphate levels increased, whereas nitrate nitrogen and ammonia nitrogen levels decreased. Dissolved oxygen concentrations remained at 75%-100% of saturation at six of the seven sampling stations. Oxygen concentrations were very low at the edge of Lake Onalaska during periods of heavy ice and snow cover. Most of the nutrient load was transported during spring runoff. The average annual discharge of suspended matter in the navigation pools was about 600,000 tons per year. The water quality parameters measured did not significantly change over the study period, 1972 to 1980.
W86-03749

INVESTIGATION OF EFFECTS OF NAVIGATION TRAFFIC ACTIVITIES ON HYDROLOGIC, HYDRAULIC, AND GEOMORPHIC CHARACTERISTICS IN THE UPPER MISSISSIPPI RIVER SYSTEM,
Simons, Li and Associates, Inc., Fort Collins, CO.
Y. H. Chen, D. B. Simons, R-M. Li, and S. S. Ellis.
In: Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium, Butterworth, Boston. 1984. p 299-324, 9 fig, 5 tab, 14 ref.

Descriptors: *Fate of pollutants, *Water pollution sources, *Environmental effects, *Navigation, *Channels, Rivers, *Sediments, Mississippi River, Illinois River, Suspended sediment, Model studies, Barges, Transportation, Boats, Mathematical models, Turbidity, Bank erosion, Erosion, Wave height, Towboats, Backwater.

A mathematical model was developed to determine the effects of navigation traffic on the physical environment of a channel. The following factors were considered: boat-generated wave heights and velocity changes, bed material resuspension and suspended sediment concentrations, turbidity, and sediment volume entering side channels and backwater areas. Calibration from data collected in the Upper Mississippi and Illinois Rivers showed reasonably good agreement between calculated and measured values. Suspended sediment concentrations were predicted to be 96%-144% greater in the year 2000 and 60%-167% greater in the year 2040 when compared with 1977. Tow traffic in 1977 produced increases in sediment volume entering backwater areas by 2.0%-3.4% above natural levels. Predicted values for 2000 and 2040 were 4.3%-9.3% and 3.5%-10.2%, respectively, above natural levels. Navigation effects were greatest when tow boats sailed close to the banks and when traffic was heavy.
W86-03750

CONTAMINANTS IN THE UPPER MISSISSIPPI RIVER: SUMMARY AND CONCLUSIONS,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 6G.
W86-03752

HYDROCHEMICAL BALANCES OF FRESHWATER SYSTEMS: PROCEEDINGS OF THE UPPSALA SYMPOSIUM.
Naturvetenskapliga Forskningslaboratoriet i Studsvik, Nykoeping (Sweden).
September 1984. IAHS-AISH Publication No 150, 1984. Edited by Erik Eriksson. 428 p.

Descriptors: *Chemical properties, Natural waters, Hydrologic data collections, *Data interpretation, *Geohydrology, *Groundwater, *Hydrologic models, *Sedimentology, Symposium, Conferences, Catchment areas, Hydrologic data, Chemical reactions.

This symposium which constitutes the Swedish contribution to the Third Phase of the International Hydrological Program addresses different hydrochemical processes which affect the composition of atmospheric precipitation, soil solutions, and surface water in rivers and lakes, and the hydrochemical balances attained in various freshwater systems. The interactions of freshwater forms with various biotic and abiotic environmental factors are not well understood. Man's activities affect many of the hydrochemical processes and thus complicate the designing of measurement systems and the interpretation of collected data. A select number of papers presented at the symposium were chosen for publication based on their representation of the scope of the conference and geographic representation. Symposium sessions treated the following subject areas: water interaction with soil and rock, data collection and adequate distribution in space and time, budgeting and modelling for catchment areas and other hydrological units, description and analysis of sorption-desorption phenomena in natural systems, and hydrochemical and sediment geochemical data as a tool for deciphering hydrological processes.
W86-03753

CARBON DIOXIDE IN THE SOIL ATMOSPHERE: SIMULATION MODEL PARAMETER ESTIMATION FROM FIELD MEASUREMENTS,
Amsterdam Univ. (Netherlands). Lab. for Physical Geography and Soil Science.
For primary bibliographic entry see Field 2G.
W86-03755

SIMULATION OF PHYSICOCHEMICAL INTERACTIONS IN A WATER-ROCK SYSTEM IN ASSESSING GROUND-WATER QUALITY,
Vsesoyuznyi Nauchno-Issledovatel'skii Inst. Gidrogeologii i Inzhenerdoi Geologii, Moscow (USSR).
For primary bibliographic entry see Field 2K.
W86-03759

SOME IMPLICATION OF THE ROLE OF KINETICS IN ENHANCING ELEMENT TRANSPORT,
Nairobi Univ. (Kenya). Dept. of Geology.
For primary bibliographic entry see Field 2K.
W86-03760

LEAD AND CADMIUM IN PRECIPITATION IN THE ESSEX REGION OF SOUTHWESTERN ONTARIO,
Windsor Univ. (Ontario). Great Lakes Inst.
M. E. Sanderson, and D. Marchand.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 215-222, 3 fig, 4 tab, 4 ref.

Descriptors: *Lead, *Cadmium, *Polychlorinated biphenyls, *Fate of pollutants, *Air pollution, *Organic compounds, *Heavy metals, *Precipitation, Seasonal variation, Path of pollutants, Rural areas, Urban areas.

This research forms part of a large multidisciplinary study of four toxic contaminants, lead, cadmium, polychlorinated biphenyls (PCB's) and octachlorostyrene, in the Essex region of Southwestern Ontario. The purpose of this part of the project is to quantify the atmospheric loading of the contaminants. A bulk precipitation sampler, wet-only precipitation sampler and recording rain gauge were installed at an urban and a rural site. One year's data indicates that atmospheric loading of lead is 35-70 times that of cadmium in both urban and rural areas. Concentrations of the metals are higher in winter than in summer but because of higher summer precipitation surface loadings are similar in both seasons. Preliminary statistical analysis indicates that concentrations of the metals are related to intensity and amount of precipitation, but not duration of precipitation or wind direction. (Author)
W86-03772

MASS-BALANCE APPROACH TO THE UNDERSTANDING OF GEOCHEMICAL PROCESSES IN AQUEOUS SYSTEMS,
Ustredni Ustav Geologicky, Prague (Czechoslovakia).
T. Paces.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 223-235, 2 tab, 39 ref.

Descriptors: *Geochemistry, *Phosphorus, *Mathematical equations, *Catchment areas, *Hydrologic budget, *Chemical reactions, *Chemical properties, *Kinetics, Mass balance, Agricultural watersheds, Forest watersheds, Rivers, Lakes.

Two types of mass-balance equations are reviewed: the local mass balance in a body of water defined by the differential equation of conservation and continuity, and the integral mass balance of aqueous systems defined by the rates of inputs, outputs, sources, sinks, and accumulation over a hydrological year. The continuous behavior of P in a polluted river, the annual mass balances of Na, Ca, Al, N, and S in forested and agricultural drainage basins of small streams, and the integral mass balances of P in a lake are presented to demonstrate the use of the equations. Although the mass balances yield data on the overall rates of geochemi-

cal processes, they are not sufficient to decipher the physicochemical and biochemical mechanisms of the processes. Elucidation of the buffering effects of geochemical reactions may best be achieved by combining results of surface-chemistry kinetic experiments with data on natural rates derived from long-term mass-balance studies in well-defined representative drainage basins.
W86-03773

HYDROCHEMICAL BUDGETS OF SOME DUTCH WOODLAND SOILS WITH HIGH INPUTS OF ATMOSPHERIC ACID DEPOSITION: MOBILIZATION OF ALUMINUM,
Agricultural Univ., Wageningen (Netherlands).
J. J. M. Van Grinsven, J. Mulder, and N. Van Breemen.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 237-247, 2 fig, 2 tab, 20 ref. EC No: ENV-650-NL.

Descriptors: *Air pollution, *Aluminum, *Hydrologic budget, *Fate of pollutants, *Acidic soils, *Nitrogen compounds, *Forest soils, *Sulfates, Water pollution sources, Nitrification, Sulfur compounds, Subsoil, *Acid rain.

Woodland soils in the Netherlands receive extremely high inputs, 4.1 to 8.6 kmol/ha/yr, of atmospheric acidic substances. Nitrification of atmospherically derived NH3, in addition to SO2 and NOx is an important source of acidity. Neutralization of these acid inputs in acidic soils is mainly accomplished by the dissolution of aluminum. To evaluate rates and mechanisms of aluminum mobilization a study was conducted on sandy and loamy acidic soils and an adjacent calcareous soil. The chemistry of rainwater, canopy throughfall and soil solutions at various depths was monitored over a 3-yr period. Chemical budgets were calculated using simulated water fluxes. In the acidic soils up to 1.5 kmol/ha/yr aluminum are mobilized from the upper 10 cm. About one third of this aluminum is immobilized in the subsoil. Ion activity products suggest that the aluminum activity in solution may be regulated by jurbanite (Al(SO4)(OH).5H2O). (Author)
W86-03774

PHYSICO-CHEMICAL CHARACTERISTICS OF SURFACE WATERS AND HYDROLOGICAL BEHAVIOR OF A SMALL GRANITIC BASIN (VOSGES MASSIF, FRANCE): ANNUAL AND DAILY VARIATIONS,
Centre National de la Recherche Scientifique, Strasbourg (France). Centre de Sedimentologie et de Geochimie de la Surface.
B. Fritz, J. C. Massabuau, and B. Ambroise.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 249-261, 4 fig, 1 tab, 16 ref.

Descriptors: *Acid rain, *Physicochemical properties, *Seasonal variation, *Water quality, *Fate of pollutants, *Daily hydrographs, *Discharge hydrographs, *Streams, Water pollution sources, Air pollution, Small watersheds, Chemical properties, Hydrologic data collections, Diurnal distribution, Anions, Cations, Trout, Granites.

Annual, daily and (acid) rainfall-induced variations of discharge, inorganic species concentrations and respiratory characteristics (O2, CO2, pH, TA, temperature) were studied in a small mountain stream draining a 36-ha granitic basin in the Vosges massif. The extension of the water-saturated area in the basin controls the diurnal discharge oscillations by evapotranspiration, and also the flood runoff volume. All solutions are dilute like typical groundwater on granite, and are strictly dependent on water discharge and temperature on all time scales studied. Alkalinity, Ca(++), Mg(++), Na(+) and SiO2 appear as tracers of alteration intensity, Cl(-), SO4(--), and K(+) as tracers of rain acid pollution. Nitrogen is fixed in the basin. The presence of trout living in extremely poorly ionized waters is reported. (Author)
W86-03775

GEOCHEMICAL STUDIES IN THE DRAINAGE BASIN OF THE RIO VOUGA (PORTUGAL). I. GENERAL HYDROGEOCHEMISTRY FROM ITS ORIGIN TO THE RIA DE AVEIRO,
Utrecht Rijksuniversiteit (Netherlands).
For primary bibliographic entry see Field 2K.
W86-03776

STUDY OF ANTHROPOGENIC INFLUENCE ON WATER QUALITY IN SOME RIVERS OF THE BALTIC SEA BASIN,
Gosudarstvennyi Gidrologicheskii Inst., Leningrad (USSR).
B. G Skakalsky.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 295-302, 3 tab, 4 ref.

Descriptors: *Water quality, *Rivers, *Mineralization, *Statistical methods, *Consumptive use, *Anions, *Cations, *Seasonal variation, Statistical analysis, Ions, Minerals, Chemical oxygen demand.

Extensive observational data covering the past 30-40 yr was used to study the anthropogenic influence on the water quality of the Neva, Western Dvina and Neman Rivers of the Baltic Sea Basin. Statistical analyses were made to discover trends in changes of mineralization, ionic composition, dichromate (COD) and permanganate (PO) oxidizability. Two periods were compared: prior to the 1960's, when the effect of man's activities were minimal, and after the 1960's, when water consumption in these regions greatly increased. Results showed that mean annual water mineralization in the rivers increased by 7-22% in the lower reaches. The anion content was characterized by a decrease in the dichromate ion and by an increase in chloride and sulfate ions. The cation content was characterized by a decrease in the calcium ion and by an increase in the concentration of sodium and potassium ions. The representativeness of initial data based on COD and PO enabled the study of seasonal changes of these constituents.
W86-03779

EROSION OF AGRICULTURAL LAND - A GROWING WATER QUALITY PROBLEM IN RURAL AREAS,
Swedish Environmental Research Inst., Stockholm.
S-O. Ryding.
In: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 303-311, 6 fig, 12 ref.

Descriptors: *Phosphorus, *Erosion, *Soil erosion, *Water quality, *Surface runoff, Sediment transport, Rural areas, *Agricultural runoff, Land use, *Water pollution sources, Catchment areas, Suspended solids, Fate of pollutants, *Agricultural watersheds, Sediment erosion.

A long-term study of surface runoff from ten drainage basins of different land-use patterns in the Scania region, southern Sweden, indicates a clear relationship between the content of erosion material and the degree of arable land. Losses of phosphorus bound to erosion material can make up a considerable portion of the total phosphorus export from agricultural areas - a loss that has been found to increase a lot during the two last decades. Transport of suspended matter was in the order of 300-500 kg/ha/yr, which with an average phosphorus content of 0.11%, resulted in a transport of phosphorus bound to particles of nearly 0.4 kg P/ha/yr. This corresponds to about one-third of the total phosphorus loss originating from different kinds of agricultural activities. Different outcomes concerning areal phosphorus losses from arable land due to varying investigation techniques are discussed. (Author)
W86-03780

WATER QUALITY AND WATER POLLUTION PROBLEMS ON THE INDIAN SUB-CONTINENT,
Central Chemical Lab., Lucknow (India).
B. K. Handa.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 313-322, 1 fig, 9 tab, 15 ref.

Descriptors: *Water quality, *Groundwater pollution, *Water pollution sources, *Water pollution, *Acid rain, *Fate of pollutants, *Stream pollution, *Water pollution effects, Heavy metals, Nutrients, Metals, Trace metals, Industrial wastes, *India, Chemical properties.

The quality of water on the Indian sub-continent varies both in space and time. The studies on the chemical composition of rainwater at several locations in India have revealed that except at Calcutta and Bombay, where acid rainfall has been recorded, the pH of rainwater is normally above 6.0. Studies on rainwater at Lucknow have revealed that the trace metal contents are normally low. The quality of surface waters in major part of the year is good with salinity being low to moderate, but in many cases due to discharge of untreated sewage and industrial effluents, the quality of stream water has deteriorated and at times fish mortality has been reported. Many of the freshwater lakes like the Dal, the Wular, the Naini Tal, the Kolleru etc. are in a state of decadence. Marine pollution off the coast of Bombay has been reported. The quality of groundwater also varies considerably. Apart from salinity problems in some parts of India, groundwaters with high F or high Fe content are also encountered. Pollution of groundwaters by plant nutrients, through return irrigation flows occurs widely. At places due to infiltration of industrial waste effluents, groundwaters with high Cr and/or high CN concentrations are also encountered. (Author)
W86-03781

MODEL EXPERIMENTAL STUDY OF HYDROCHEMICAL PROCESSES IN THE SATURATED ZONE,
Higher Inst. of Mining and Geology, Sofia (Bulgaria).
For primary bibliographic entry see Field 2K.
W86-03785

SEPARATION OF RUNOFF COMPONENTS BY NO3-N LOADING AND ESTIMATION OF RUNOFF LOADING BY EACH COMPONENT,
National Inst. for Environmental Studies, Tsukuba (Japan).
S. Ebise.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 393-405, 11 fig, 9 ref.

Descriptors: *Runoff, *Nitrates, *Nitrogen, *Storm runoff, *Hydrologic models, *Rainfall-runoff relationships, *Storm seepage, *Surface runoff, Flood discharge, Load distribution, Models, Nonpoint pollution sources.

Separation of runoff components is useful not only for flood analysis but also for estimation of runoff loadings. The change in relationship, during direct storm runoff, between NO3-N loading (Y-axis) and discharge (X-axis) on log-log paper counterclockwise differs from other water quality indicators. The peak of NO3-N loading appears behind that of discharge, and NO3-N concentration rises for the latter half of runoff, compared with that preceding the storm. Considering this change of NO3-N loading as a tracer of prompt-subsurface runoff, the direct runoff component could be separated by Sugawara's Tank Model, which has second-step tanks. Runoff from the first tank corresponds to surface runoff, and that from second tank to prompt-subsurface runoff. The particulate pollutant load from nonpoint sources, accumulated upon the ground surface of the basin, is washed off mainly by surface runoff. The dissolved substance load from the surface soil layer is carried away by subsurface runoff. (Author)
W86-03788

PROCEEDINGS OF STORMWATER AND WATER QUALITY MANAGEMENT MODELING USERS GROUP MEETING.
Environmental Research Lab., Athens, GA.
March 25-26, 1982, Washington, DC. Thomas O. Barnwell, editor. EPA-600/9-82-015, August 1982. 298 p.

Descriptors: *Mathematical models, *Computer models, *Hydrologic models, Storm design, Sediment transport, Hydrology, Storm water, Aeration, Pollution load, Nonpoint pollution sources.

This report includes 16 papers on topics related to the development and application of computer-based mathematical models for water quantity and quality management presented at the semi-annual meeting of the Joint U.S.-Canadian Stormwater and Water Quality Modeling Users Group held 25-26 March 1982 in Washington, DC. Topics covered include a study of selection, calibration and verification of water quality models in Louisiana and an assessment of measurement uncertainty in the estimation of stream reaeration rates for these models. Calibration of hydrology and sediment transport on small agricultural watersheds using the Hydrological Simulation Program-FORTRAN is described. Hydrologic modeling for studies of pollutant loads and transport in large river basins and the use of continuous simulation model calibration techniques to develop nonpoint pollution loading factors were described. A verification of a continuous dissolved oxygen model for a river in Missouri was presented. State-of-the-art data acquisition techniques in hydrometeorology were discussed. Mathematical analyses of turbulence in center-feed circular sedimentation basins and for dynamic model calibration are presented. Preparing storm designs for urban drainage analysis was presented as well as studies of pollutant concentrations and loading in highway runoff. An application of the EXTRAN model to offsite drainage is described. A desk-top calculator method for nonpoint source loads evaluation is described. Modifications to the QUAL-II model for continuous simulation of fecal coliforms is presented. A literature review was done of the relationship between atmospheric pollution and stormwater quality.
W86-03822

STUDY OF THE SELECTION, CALIBRATION AND VERIFICATION OF MATHEMATICAL WATER QUALITY MODELS,
National Council of the Paper Industry for Air and Stream Improvement, Inc., Medford, MA.
R. C. Whittemore, J. S. Hovis, and J. J. McKeown.
In: Proceedings of Stormwater and Water Quality Management Modeling Users Group Meeting, March 25-26, 1982, Washington, DC. EPA-600/9-82-015, August 1982. p 1-35, 13 fig, 11 tab, 14 ref.

Descriptors: *Mathematical models, *Hydrologic models, *Calibration, Dissolved oxygen, Biological oxygen demand, Watersheds, Ouachita River.

The general objective of this study was to examine the differences among various models when applied to a single watershed in order to illustrate the limitations inherent in mathematical water quality modeling. More specifically, the study objectives were (a) testing the validity of four commonly used water quality models under increasingly strict calibration and verification criteria, (b) examining the predictive capability of these models for conditions of varying complexity, and (c) elucidating the dominant issues with respect to model selection, calibration and verification which are believed to be of concern in most waste load allocation studies. Dissolved oxygen, biological oxygen demand and nitrogen species were shown to be independent variables.
W86-03823

CONTINUOUS DO RESPONSE PREDICTED USING CSPSS IS VERIFIED FOR SPRINGFIELD, MISSOURI,
CH2M Hill International Corp., Gainesville, FL.
J. E. Scholl, and R. L. Wycoff.
In: Proceedings of Stormwater and Water Quality Management Modeling Users Group Meeting, March 25-26, 1982, Washington, DC. EPA-600/9-82-015, August 1982. p 90-100, 3 fig, 3 tab, 3 ref.

Descriptors: *Dissolved oxygen, *Mathematical models, *Simulation analysis, *Water pollution, *Storm wastewater, Water pollution effects, Simulation, Storm water, Storm runoff, James River-MO.

Receiving water impacts on the James River near Springfield, Missouri were evaluated using the Continuous Stormwater Pollution Simulation System (CSPSS). The simulation of James River dissolved oxygen (DO) concentrations was calibrated to match the continuous in-stream DO measurements collected by the USGS between 1974 and 1977. This calibrated CSPSS model was then used to simulate the impact of the recently completed (November 1977) AWT facility in Springfield and to quantify the impact of alternatives to control pollution from urban stormwater runoff. Since 1954, six major fishkills have occurred on the James River after storm events. At the outset of this project, the cause of those major fishkills was suspected to be urban stormwater pollution. However, the use of CSPSS has indicated that the poor quality secondary effluent of the WWTP, rather than urban stormwater pollution, was probably the major cause of these fishkills. It is the purpose of this paper to present information which verifies the conclusions reported in the paper by Scholl and Wycoff (1981). The verification was obtained by developing a cumulative duration curve for DO concentrations observed at the calibration point on the James River between 1979 and 1980 (post-AWT conditions).
W86-03826

HYDROLOGIC MODELING FOR STUDIES OF POLLUTANT LOADINGS AND TRANSPORT IN LARGE RIVER BASINS,
Northern Virginia Planning District Commission, Annandale.
For primary bibliographic entry see Field 5A.
W86-03827

USE OF CONTINUOUS SIMULATION MODEL CALIBRATION TECHNIQUES TO DEVELOP NONPOINT POLLUTION LOADING FACTORS,
Northern Virginia Planning District Commission, Annandale.
J. P. Hartigan, T. F. Quasebarth, and E. Southerland.
In: Proceedings of Stormwater and Water Quality Management Modeling Users Group Meeting, March 25-26, 1982, Washington, DC. EPA-600/9-82-015, August 1982. p 101-127, 11 fig, 5 tab, 9 ref.

Descriptors: *Mathematical models, *Loading factors, *Nonpoint pollution sources, Chesapeake Bay, Nitrogen compounds, Phosphorus compounds, Pollution load, Hydrologic models.

The purpose of the River Basin modeling study of the Chesapeake Bay was to compare the delivery of point source and nonpoint pollution loadings of nitrogen and phosphorus to the Bay's estuarine system. The model was also used to evaluate alternate eutrophication management strategies for the Bay's estuarine system. To develop nonpoint pollution loading factors for rural-agricultural and urban land use categories, a version of USEPA's NPS model was calibrated to several test watersheds characterized by relatively homogeneous hydrologic characteristics and a single land use. A total of 25 test watersheds were monitored from late 1979 through mid-1981 under a $2.5 million study funded by the EPA Chesapeake Bay Program. An earlier twelve-month monitoring study (1976-1977) of 16 urban test watersheds in the Virginia suburbs of Washington, DC. produced the majority of the urban nonpoint pollution loading data. This paper focuses on the development of rural-agricultural loading factors and the verification of 1976-1977 urban loading factors described elsewhere through the calibration of the NPS model to the EPA Chesapeake Bay Program test watersheds. River Basin Model simulations which verified the nonpoint pollution loading factors are also described.
W86-03828

PREDICTIVE MODEL FOR HIGHWAY RUNOFF POLLUTANT CONCENTRATIONS AND LOADINGS,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W86-03834

DESK TOP METHODOLOGY FOR NONPOINT SOURCE LOAD EVALUATION,
Weston (Roy F.), Inc., West Chester, PA.
A. K. Deb.
IN: Proceedings of Stormwater and Water Quality Management Modeling Users Group Meeting, March 25-26, 1982, Washington, DC. EPA-600/9-82-015, August 1982. p 248-259, 5 tab, 1 ref.

Descriptors: *Mathematical analysis, *Computer models, *Runoff forecasting, *Computer program, *Nonpoint pollution sources, Land use, Runoff coefficient, Storm water, Data interpretation.

This paper outlines a simplistic methodology for nonpoint source loading evaluation, in areas where rate coefficients and loadings can be estimated. The methodology has limited application, and can be used for first level of analysis, areas with similar characteristics where rate coefficients and loadings have been developed, and for determining the need for detailed computer modeling. The step-by-step methodology developed in this paper for evaluation of nonpoint source loads incorporates the following steps: (1) historical rainfall data analysis and selection of a design storm, (2) determination of the land use pattern of the study area, (3) determination of the percent of imperviousness of the various land use types, (4) estimation of the composite run-off coefficient for the study area, (5) estimation of the stormwater run-off rates, (6) calculation of pollutant accumulation on each land use at the start of the storm, and (7) estimation of the stormwater run-off loads.
W86-03836

CONTINUOUS SIMULATION OF INSTREAM FECAL COLIFORM BACTERIA,
Proctor and Redfern Ltd., Ottawa (Ontario).
A. C. Rowney, and L. A. Roesner.
IN: Proceedings of Stormwater and Water Quality Management Modeling Users Group Meeting, March 25-26, 1982, Washington, DC. EPA-600/9-82-015, August 1982. p 260-273, 5 fig, 4 tab.

Descriptors: *Mathematical models, *Computer programs, *Coliforms, *Simulation analysis, Wastewater, Storm wastewater, Stream pollution, Rideau River.

The simulation of fecal coliform bacteria in an urban stream is discussed in light of a recent study of the Rideau River at Ottawa, Canada. As part of this study, it became necessary to verify the use of a one-dimensional advection/dispersion river model incorporating first order decay in the simulation of fecal coliform bacteria. An extensive time-series data base was gathered for calibration and verification of the model QUAL-II. This data base was supplemented with runoff data simulated using STORM. It was found that the selected models provided a good representation of major processes in the test reach selected, certainly adequate for planning purposes. Some preliminary statistics representing the goodness of fit of simulated to observed instream concentrations are presented. In addition, modifications made to QUAL-II to permit simulation of time series input conditions are briefly discussed. (Author)
W86-03837

ATMOSPHERIC POLLUTION IN RELATION TO STORM WATER QUALITY MODELLING: LITERATURE REVIEW FOR AN INDUSTRIAL CITY,
McMaster Univ., Hamilton (Ontario).
B. Shivalingaiah, and W. James.
IN: Proceedings of Stormwater and Water Quality

Management Modeling Users Group Meeting, March 25-26, 1982, Washington, DC. EPA-600/9-82-015, August 1982. p 274-295, 4 fig, 3 tab, 26 ref.

Descriptors: *Mathematical models, *Computer programs, *Nonpoint pollution sources, *Fallout, Air pollution, Storm water, Computer models, Water quality, Lake Ontario.

The atmosphere is one of the largest sources of pollutants in surface runoff in an industrial city. The location of the major industrial areas, wind direction and velocity, and source concentrations, are important parameters in the prediction of the atmospheric fallout are correlated with these parameters and superimposed on the discretized catchment. The total accumulated dry weather loading is input to the water quality sections of SWMM-RUNOFF. The water quality algorithms in SWMM III are reviewed and improvements suggested, eg. inclusion of atmospheric fallout and scavenging, street sweeping time series data, separation of pollutant source areas, variable time step hydrology and moving storm analysis. (Author)
W86-03838

POLLUTANT TRANSPORT IN MISSISSIPPI SOUND: INTERIM TECHNICAL REPORT III,
Gulf Coast Research Lab., Ocean Springs, MS. Analytical Chemistry Section.
T. F. Lytle, and J. S. Lytle.
MASGP-82-015, November 1982. 20 p, 5 fig, 1 tab, 2 ref.

Descriptors: *Pollutants, *Sediment concentrations, Chemical analysis, Hydrocarbons, Chemical composition, Cores, Mississippi Sound.

A pollutant transport study to address pollution issues affecting present and future development of coastal areas of Mississippi is described. The program entailed collection of sediment cores from several locations in Mississippi Sound over a three-year period from 1979 through 1981. Each core was analyzed for total phenols, total organic carbon, total Kjeldahl nitrogen, and hydrocarbons. The data were used to address those pollution issues affecting present and future development of coastal areas. The likelihood that various activities, such as boating activity, tidal impact and dredging, would disturb the sediments and release those pollutants to the water column, was considered. Bioassays were conducted on mysid shrimp, sheepshead minnows, and amphipods to determine the relative toxicities of the surface sediments from various areas within the Sound. The use of this project in several educational programs is discussed. (Halterman-PTT)
W86-03839

DISPERSION OF SEDIMENT RESUSPENSION CAUSED BY DREDGE OPERATION,
Japan Dredging and Reclamation Engineering Association, Tokyo.
H. Koba.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/Japan Experts Meeting. March 1985. p 90-105, 11 fig, 9 tab, 6 ref.

Descriptors: *Dredging, *Sedimentation, Sediment load, Pollution, Sediment transport, Suspended solids, Suspension, Suspended sediments, Japan, Turbidity, Model studies.

As a working model of dispersion of sediment resuspension caused by dredge operation, a model of turbidity levels according to distance from the dredge is useful. The level of turbidity near the sea bottom is estimated to be 5 ppm at a distance of 100 m and 3 ppm at 200 m from the dredge. Also, the level of turbidity near the water surface never exceeds that at the sea bottom. Therefore, it is not believed that dredging work will make a wide area of the sea turbid. (Author)
W86-03873

NEW TECHNIQUES DEVELOPED IN JAPAN FOR OIL SPILL CLEANUP,
Japan Workvessel Association, Tokyo.
I. Ofuji, and N. Ishimatsu.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/Japan Experts Meeting. March 1985. p 114-131, 16 fig, 4 tab, 6 ref.

Descriptors: *Oil pollution, *Pollutants, *Oil recovery, *Toxic wastes, Oily water, Secondary oil recovery, Cleanup operations, Oil skimmers, Water pollution control.

In the last decade, the total number of reported water pollution incidents in Japan has decreased by 36 percent. Of these incidents, 80 percent are oil spills. Three oil recovery systems currently being used in Japan are discussed in this paper. The first one is an oil recovery system that uses aeration to separate the oil and the water. It is intended for recovery of low viscosity oil that spreads itself over the water surface as a thin film. The second, or rotary bucket oil recovery system, is used to clean up spills of high viscosity oil, like crude or heavy oil, which remains on the water surface in a thick layer. The third is a gelatinization recovery system that converts all types of oil into a semisolid consistency for easy mechanical recovery. (Author)
W86-03875

MEASUREMENT OF NUTRIENT CONCENTRATIONS IN SEDIMENT PORE WATER COLLECTED BY A DIALYSIS SAMPLER,
Japan Bottom Sediment Management Association, Tokyo.
For primary bibliographic entry see Field 5A.
W86-03877

5C. Effects Of Pollution

EFFECT OF SOIL ON THE MUTAGENIC PROPERTIES OF WASTE WATER,
Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
M. J. Plewa, and P. K. Hopke.
UILU-WRC-84-195, WRC Research Report No 195, December 1984, Project Completion Report. 42 p, 22 fig, 1 tab, 20 ref. S-095-ILL. 1-1-11527.

Descriptors: *Land disposal, *Wastewater disposal, *Assays, *Clay loams, *Mutagens, *Ecological effects, Waste disposal, Leaching, Soil, Soil amendments, Sludge, Solid waste disposal, Sludge disposal, Water pollution effects, Illinois.

The disposal of wastewater on agricultural lands poses known and unknown environmental risks. Mutagens may be introduced into the ecosystem and perhaps concentrated by crop plants or leached into groundwater supplies. The biological effect of a mutagenic wastewater before and after application to soil was investigated using an XAD-8 methanol extract of wastewater from the municipal sewage treatment plant at Sauget, Illinois. One and three ml of extract were brought up to 10 ml volumes with water and added to 10 g of sterile or nonsterile native clay loam. These mixtures were placed in a shaking water bath at room temperature for 0, 24, and 48 hr. After separation of solid and liquid portions by filtration, dichloromethane was added to extract the organic fractions from each component. Solvent extractions were evaporated to dryness and brought up in DMSO. Tests for mutagenic activity were conducted using strain TA98. After addition to the soil for greater periods of time, the mutagenic activity decreased. The solid component exhibited greater mutagenic activity than the liquid. The XAD-8 extract was also assayed using the yg2 assay in Zea mays and the micronucleus assay in Tradescantia. The extract did not induce mutation or chromosome aberations in these assays. The sludge from the Sauget plant was chemically fractionated and assayed with S. typhimurium strains TA98 and TA100. The neutral fraction was the most mutagenic fraction followed by the weak acid, strong acid and basic fractions. (Geiger-PTT)
W86-03502

GIARDIASIS IN WASHINGTON STATE,
Washington State Dept. of Social and Health Services, Olympia. Office of Environmental Health Programs.
F. Frost, L. Harter, B. Plan, K. Fukutaki, and B. Holman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-134882, Price codes: A05 in paper copy, A01 in microfiche. EPA-600/1-82-016, November 1982. 80 p, 1 fig, 29 tab, 13 ref, 3 append. R-805809.

Descriptors: *Protozoa, *Giardiasis, *Human diseases, *Washington, *Drinking water, *Infection, *Fate of pollutants, Public health, Water pollution effects, Diseases, Risks, Mammals, Potable water, Well water, Surface water, Spring water, Path of pollutants, Pollutant identification.

The objective was to determine the potential for transmission of giardiasis through approved drinking water supplies in Washington State. The project consisted of five studies: the first was conducted during trapping seasons (1976-1979) and resulted in examining of 656 beaver stool samples, 172 muskrat and 83 other animal stools. Positivity for beaver was 10.8%, for muskrat, 51.2%. No Giardia was found in other mammals. The second study contacted 865 Giardia-infected Washington State residents to identify likely sources or possible risk factors for infection. Clusters of cases were linked to day care centers, backpacker groups or sites for drawing water on outings and foreign travel. No excess cases were observed for users of surface drinking water supplies. The third study was a case-control study to identify risk factors for giardiasis. Factors which appeared to place a person at increased risk included consumption of untreated water, foreign travel and attendance at a day care center. The fourth study examined water filtering techniques for recovery of Giardia cysts from drinking water supplies and yielded improvements in recovery. The fifth study was a stool survey of children in Skagit and Thurston counties. Overall prevalence of infection was 7.1%. No differences in the prevalence were found by source of domestic water (surface filtered, surface unfiltered, well or spring). (Author)
W86-03507

ONSHORE IMPACTS OF OFFSHORE HYDROCARBON DEVELOPMENT: ANNOTATED BIBLIOGRAPHY,
Environmental Protection Service, Ottawa (Ontario).
F. A. Kwamena, C. Brassard, and D. Wright.
EPS 3-EC-83-4, December, 1983. 108 p.

Descriptors: *Water pollution effects, *Coastal zone management, *Oil pollution, *Offshore platforms, *Water pollution sources, *Bibliographies, *Environmental effects, *Planning, Economic impact, Social impact, Hydrocarbons, Oil wells, Natural gas, Shore protection, Continental shelf, Drilling, Alaska, Canada, Norway, United Kingdom, North America, Exploration, Arctic, Oil spills, Marine resources, Resources development, Pipelines, Environmental protection, Fate of pollutants.

The onshore impact of offshore oil and gas development is reviewed in an annotated bibliography, emphasizing issues and recommendations. This is a preliminary step in planning for future hydrocarbon exploration and production in Canada. Sections include coastal zone management, facility types and requirements, socioeconomic impacts, environmental impacts, and experiences in the United Kingdom, Norway, and North America. Papers concerning Alaska, the Gulf States, and the North Sea are numerous.
W86-03620

HEALTH AND DISEASE CONTROL FOR AQUATIC ANIMALS IN DREDGED MATERIAL CONTAINMENT SITES,
Texas A and M Univ., College Station.
S. K. Johnson.
In: Aquaculture in Dredged Material Containment Areas: Proceedings, September 1982, Galveston, TX. Miscellaneous Paper D-83-2, October 1983. p

131-134, 5 ref.

Descriptors: *Water pollution effects, *Ponds, *Fish farming, *Fish ponds, *Water quality, *Aquatic habitats, *Aquaculture, *Fish ponds, *Fish diseases, *Dredging, Fish parasites, Parasites, Animal diseases, Invertebrates, Algae, Crustaceans, Copepods, Isopods, Protozoans, Fungi.

Certain diseases and parasites are likely to develop in dredging containment sites because of high animal density, weather influences, and progressive enrichment of culture water. Crustacean parasites such as Ergasilus (copepods), fish lice, isopods, protozoans, helminths, and algal blooms are potential problems. Sudden temperature drops cause fishkills and fungal infections. Temperatures above 30 degrees C support bacterial diseases. Vibrio is a common cause of such disease. Weather can also affect salinity and stir up bottom sediments. Progressive water enrichment produces oxygen shortage and an abundance of fouling organisms.
W86-03709

SELECTION CRITERIA AND PROCEDURES FOR ESTABLISHING MARICULTURE FACILITIES IN EXISTING CONTAINMENT SITES,
Dow Chemical U.S.A., Freeport, TX. Texas Div.
D. Milligan.
In: Aquaculture in Dredged Material Containment Areas: Proceedings, September 1982, Galveston, TX. Miscellaneous paper D-83-2, October 1983. p 153-162, 5 fig.

Descriptors: *Water pollution effects, *Ponds, *Dredging, *Aquaculture, *Aquatic habitats, Lakes, Brackish water, Shrimp, Aquatic life, Aquatic animals, Toxicity, Brown shrimp, Fish, Predation, Sheepshead minnow.

The feasibility of aquaculture in dredging containment sites was studied in three phases. Phase 1 was chemical analysis of dredged material and 96-hour bioassays which exposed shrimp to dredged material in seawater. The dredged material contained no significant concentrations of heavy metals, pesticides, and waste metabolites. Bioassays showed no toxicity. Phase 2 consisted of simulated containment areas studied in small ponds lined with dredged material (control ponds contained no dredge material). In the ponds containing dredged material brown shrimp grew faster and larger, less fertilizer was needed, and no extraordinary mortality was noted. Phase 3, in a 20-acre actively used contaminant site, experienced significant problems: mortality from post-larval stage to harvest was 84%, harvesting was a problem because the pond bottom was irregular, total predator control was difficult. However, shrimp were wholesome and marketable.
W86-03712

PHYTOPLANKTON-ENVIRONMENTAL INTERACTIONS IN RESERVOIRS: VOLUME 1.
For primary bibliographic entry see Field 2H.
W86-03716

USE OF BIOASSAY APPROACHES FOR ASSESSING PHYTOPLANKTON GROWTH IN LAKES AND RESERVOIRS,
Utah Water Research Lab., Logan.
D. B. Porcella, and M. L. Cleave.
In: Papers Presented at Workshop, April 10-12, 1979, Monterey, CA. Technical Report E-81-13, September 1981. p 276-314, 6 fig, 4 tab, 63 ref.

Descriptors: *Water pollution effects, *Lakes, *Reservoirs, *Bioassay, *Algae, *Phytoplankton, *Water analysis, Biomass, Toxicity, Nutrients, Eutrophication, Phosphorus, Wastewater analysis, Organic compounds, Inorganic compounds, Salinity, Reservoir management, Land use, Seasonal variation, Environmental effects.

A literature review revealed that the algal assay procedure:bottle test is useful for bioassaying water samples to assess chemical constituents. The test should not be used directly to interpret ecological relationships. However, the evaluation of chemical constituents by algal growth has many advantages. It is a single, integrated, biological measurement of constituents in a sample that exerts impact as a function of chemical concentration. The algal bioassay measures the effects of biostimulatory and toxic compounds. Examples illustrating the application of the algal bioassay to management questions about effects of nutrients, toxic compounds, and salts show that the test can be used for determining the relative effects of these substances. The algal bioassay can be used in reservoir studies to assess the effects of changes in effluent discharges, tributary diversion and/or combination, evaluating water quality of potential reservoirs, changes in reservoir operation (mixing, discharge timing and location, restoration), effects of differing land uses, downstream effects, and seasonal variation in inflow/outflow. (Author)
W86-03723

ROLE OF CONTAMINANTS IN THE DECLINE OF THE ILLINOIS RIVER: IMPLICATIONS FOR THE UPPER MISSISSIPPI,
Illinois Natural History Survey, Champaign.
For primary bibliographic entry see Field 6G.
W86-03739

HYDROCHEMICAL BALANCES OF FRESHWATER SYSTEMS: PROCEEDINGS OF THE UPPSALA SYMPOSIUM.
Naturvetenskapliga Forskningslaboratoriet i Studsvik, Nykoeping (Sweden).
For primary bibliographic entry see Field 5B.
W86-03753

WATER QUALITY AND WATER POLLUTION PROBLEMS ON THE INDIAN SUB-CONTINENT,
Central Chemical Lab., Lucknow (India).
For primary bibliographic entry see Field 5B.
W86-03781

AEROBIC TRANSFORMATION OF NITROGENOUS SUBSTANCES IN A FRESHWATER ECOSYSTEM,
Slovenska Akademia Vied, Bratislava (Czechoslovakia).
D. Toth.
In: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 323-330, 3 fig, 15 ref.

Descriptors: *Stream pollution, *Water pollution effects, *Ecosystems, *Ecological effects, *Agricultural chemicals, *Nitrogen compounds, *Bacteria, Mathematical models, Fertilizers, Pesticides, Nitrogen, Ammonia, Nitrite, Nitrate, Water pollution.

In the study of the Slnava water reservoir on the river Vah and the agricultural catchment area of western Slovakia, many external influences on the complex ecosystem were identified. The study was carried out by means of laboratory experiments, field measurements and simulation analyses using the mathematical model for aerobic nitrogen transformation in a water environment. An excessive external supply of substrates in the form of ammonia and nitrate was found. An inhibitory effect of pesticides on heterotrophic and nitrifying bacteria and sharp changes in physical parameters were demonstrated. Increased input rates of ammonia and nitrate-nitrogen from the applied fertilizers are accelerating the rate of the nitrification process, resulting in the accumulation of nitrates. This process is combined with the inhibitory effect of free ammonia on bacteria. The increased input of agrochemicals to the water reservoir has disturbed some important processes of the biogeochemical cycles which may lead to the instability of the ecosystem. Pollution of streams with nitrification inhibiting agents may increase the concentration of nitrite and slow the oxidation of ammonia. Normal sedimentation processes in the Slnava reservoir create favorable conditions for the absorption of ammonia in bottom mud and for the accumulation of pesticides.
W86-03782

CONTINUOUS DO RESPONSE PREDICTED USING CSPSS IS VERIFIED FOR SPRINGFIELD, MISSOURI,
CH2M Hill International Corp., Gainesville, FL.
For primary bibliographic entry see Field 5B.
W86-03826

MANAGEMENT OF BOTTOM SEDIMENTS CONTAINING TOXIC SUBSTANCES: PROCEEDINGS OF THE 9TH US/JAPAN EXPERTS MEETING.
Army Engineer Inst. for Water Resources, Fort Belvoir, VA.
For primary bibliographic entry see Field 5G.
W86-03867

AERATION EFFECTS ON MARINE EUTROPHICATION,
For primary bibliographic entry see Field 5G.
W86-03868

HYPOLIMNETIC OXYGEN DEFICIT IN A EUTROPHIC LAKE AND THE ROLE OF SEDIMENT OXYGEN DEMAND,
National Inst. for Environmental Studies, Tsukuba (Japan).
M. Okada, R. Sudo, M. Takasaki, and A. Sato.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/Japan Experts Meeting. March 1985. p 27-40, 8 fig, 2 tab, 17 ref.

Descriptors: *Lake sediments, *Sediments, *Lakes, *Toxic wastes, Dissolved oxygen, Sediment oxygen demand, Eutrophic lakes, Lake stages, Limnology, Lake Yunoko, Japan, Hypolimnion, Thermal stratification.

Lake surveys and in situ experiments were conducted to study the hypolimnetic oxygen deficit in a eutrophic lake, Lake Yunoko. A mathematical model was developed to estimate the dissolved oxygen budget in the lake. Production of oxygen by photosynthesis of phytoplankton, consumption by respiration of microorganisms, sediment oxygen demand, and oxygen transfer by eddy diffusion and reaeration at the surface of water were taken into consideration. It was shown from the budget that sediment oxygen demand plays an important role in the first stage of the hypolimnetic oxygen deficit in summer; i.e., the oxygen produced by photosynthesis was not transferred into the hypolimnion and the contribution of sediment oxygen demand was as large as that of the consumption in water. Restoration techniques for the oxygen deficit such as management of bottom sediment and control of phytoplankton production were discussed. The management of bottom sediment was shown to be an effective way to control the hypolimnetic oxygen deficit in Lake Yunoko. (Author)
W86-03869

DISPERSION OF SEDIMENT RESUSPENSION CAUSED BY DREDGE OPERATION,
Japan Dredging and Reclamation Engineering Association, Tokyo.
For primary bibliographic entry see Field 5B.
W86-03873

ACCUMULATION OF ACRYLAMIDE INTO FISH,
Tsukuba Univ. (Japan). School of Medicine.
J. Asada, T. Shimizu, S. Tajima, F. Sakamoto, and M. Fujiki.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/Japan Experts Meeting. March 1985. p 161-172, 9 fig, 2 tab, 20 ref.

Descriptors: *Acrylamide, *Fish, *Toxic wastes, Environmental effects, Carp, Chemical analysis, Chemical composition, Chromatography, Gas chromatography, Red sea bream.

The accumulation of acrylamide monomer and polymer into fish and the behavior of acrylamide monomer in the aqueous environment were investigated. Red sea bream and carp were used as experimental fish. Fishes were placed in fish-rearing tanks with freshwater and/or seawater containing acrylamide monomer and/or polymer and were reared for 25 days. The accumulation of acrylamide monomer into red sea bream from seawater containing 10 ppm acrylamide monomer reached 1.2 ppm after 20 days. Acrylamide monomer accumulated in organs of carp from water by the following factors: liver--0.5, kidney--0.5, gills--0.15, muscle--0.17, and blood 0.19. The degradability of acrylamide monomer in tap water and distilled water was slight. Approximately 90% of the acrylamide monomer in seawater and pond water was degraded after 14 days. Acrylamide monomer in fish breeding water decreased to undetectable levels in 5 days. From this experiment, it was clear that the rate of accumulation of acrylamide into fish was slight, and acrylamide monomer in environmental water was easily degradable. (Author)
W86-03878

5D. Waste Treatment Processes

WATER RECYCLING IN THE PULP AND PAPER INDUSTRY IN CALIFORNIA,
Camp, Dresser and McKee, Inc., San Francisco, CA.
For primary bibliographic entry see Field 3E.
W86-03437

INTRODUCTION TO WASTEWATER TREATMENT PROCESSES,
Laval Univ., Quebec.
R. S. Ramalho.
Second Edition. Academic Press, New York. 1983. 580 p.

Descriptors: *Activated sludge process, *Biological wastewater treatment, Reviews, Tertiary wastewater treatment, Model studies, Pilot plants, Design criteria, Chemical reactions, Chemical treatment, Advanced wastewater treatment, Wastewater treatment.

This book is an introductory presentation meant for both students and practicing engineers interested in the field of wastewater treatment. The book discusses the design of specific wastewater treatment processes followed by a summary of the theory involved in the process, a definition of the important design parameters involved in the process and the determination of such parameters using laboratory-scale or pilot-plant equipment, and the development of a systematic design procedure for the treatment plant. Numerical applications are presented which illustrate the treatment of laboratory data, and subsequent design calculations are given for the wastewater processing plant. Specific topics covered include: characterization of domestic and industrial wastewaters, pretreatment and primary treatment, theory and practice of aeration in wastewater treatment, secondary treatment (the activated sludge process), secondary treatment (other aerobic and anaerobic wastewater treatment processes), sludge treatment and disposal, and tertiary wastewater treatment. This revised edition places greater emphasis upon the principles of chemical kinetics, reactor design, and the mechanism of biological treatment processes. (Geiger-PTT)
W86-03455

CHARACTERISTICS AND TREATABILITY OF URBAN RUNOFF RESIDUALS,
Rexnord, Inc., Milwaukee, WI. Environmental Research Center.
For primary bibliographic entry see Field 5B.
W86-03508

NONLINEAR PROGRAMMING MODEL OF A WASTEWATER TREATMENT SYSTEM: SENSITIVITY ANALYSIS AND A ROBUSTNESS CONSTRAINT,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
J. G. Uber, E. D. Brill, and J. T. Pfeffer.
UILU-WRC-85-196, WRC Research Report No 196, June 1985. 105 p, 5 fig, 23 tab, 27 ref, 2 append. S-092-ILL.

Descriptors: *Sensitivity analysis, *Wastewater treatment, *Design criteria, *Wastewater facilities, *Mathematical models, Numerical analysis, Mathematical studies, Models, Cost analysis, Systems analysis, Optimization, Model studies, Performance evaluation.

A method for sensitivity analysis in nonlinear programming is described and then illustrated using a least-cost model of a secondary wastewater treatment system. A sensitivity equation approach is used to calculate normalized sensitivity coefficients, which approximate the percent changes in model variables and objective function due to a small parameter variation. Design changes predicted by the sensitivity coefficients are confirmed by a perturbation analysis of the optimal solution. Sensitivity concepts are used to develop a robustness measure which is incorporated into the constraint set of the nonlinear model. Robustness is narrowly defined as the ability of a model solution to maintain a level of performance that meets the system design criteria even if the actual values of model parameters are not exactly the same as the values assumed for design. A gradient optimization procedure is used to examine the tradeoff between total cost and the robustness measure. A preliminary analysis shows that the trends in robust wastewater treatment plant design are in direct conflict with the optimal decisions obtained when minimizing cost without a constraint on robustness but are in agreement with those designs observed to work in practice. The robustness constraint method presented should be applicable to other optimization models of water resources systems. (Author)
W86-03511

PILOT-SCALE EVALUATION OF THE NUTRIENT FILM TECHNIQUE FOR WASTEWATER TREATMENT,
Cold Regions Research and Engineering Lab., Hanover, NH.
J. R. Bouzoun, C. J. Diener, and P. L. Butler.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A123429. Price codes: A03 in paper copy, A01 in microfiche. Special Report 82-27, November 1982. 34 p, 17 fig, 11 tab, 12 ref.

Descriptors: *Plant growth, *Nutrient removal, *Rhizosphere, *Biofilters, *Biological wastewater treatment, Membrane processes, Nutrients, Wastewater treatment, Biological membranes, Biochemical oxygen demand, Filtration, Pilot plants, Root zone, Organic compounds.

An experiment was conducted to determine the feasibility of using several plant species in a pilot-scale nutrient film technique (NFT) installation to further treat primary-treated effluent. NFT is a modified hydroponic plant growth method in which a thin film of wastewater flows through the root mat of plants that grow on an impermeable and slightly inclined surface without soil. It was hypothesized that the root mat of the plants would filter suspended solids from the wastewater, serve as a physical structure on which microorganisms utilizing nutrients can attach, and collect nutrients for use by the plants themselves. Tracer studies showed that the hydraulic retention time of the wastewater in the NFT trays was inversely related to the wastewater application rate, and that for a given flow, plants with fine root systems (reed canarygrass) had a much longer detention time than plants with coarse tuberous rhizomes (cattails). Results showed that the NFT produced useful byproducts while treating primary effluent. NFT removal of biochemical oxygen demand (BOD) depended on filtration and sedimentation of the particulate fraction of BOD and on biological oxidation of soluble BOD. The removal of BOD by the NFT was successfully modeled using the plug-flow reactor model and first-order kinetics. The NFT was also capable of significantly reducing the levels of volatile and nonvolatile trace organic compounds in primary-treated wastewater. (Geiger-PTT)
W86-03515

CHEMISTRY IN WATER REUSE: VOLUME 1,
Ann Arbor Science, Ann Harbor, MI, 1981. Edited by William J. Cooper. 557 p.

Descriptors: *Water reuse, *Wastewater treatment, *Industrial wastewater, *Pollutant identification, Water treatment, Membrane processes, Disinfection, Water analysis, Recycling, Wastewater analysis, Fate of pollutants, Reverse osmosis, Chlorine, Metals, Organic compounds, Monitoring, Quality control.

Developments in chemistry of water reuse and recycling include a review of the published literature of this subject; most activity has been in pulp and paper, electroplating, inorganic chemicals, petroleum refining, iron and steel, and food products industries. Monitoring and control of pollutants are discussed. Ultraviolet absorbance is useful in measuring the organic pollution in wastewater. Quality assurance programs for water and wastewater analysis are described. The Industrial Environmental Research Laboratory of the EPA has a comprehensive program. Membrane processes are used to remove a variety of pollutants from industrial wastewaters: electroplating wastes, battery manufacturing rinse water, textile process water, carcinogen laboratory wastes, and municipal/industrial sewage effluents. The section on disinfection has methods for disinfecting water and wastewater to minimize trihalmethane formation and residual chlorine and the determination of chlorine compounds such as chlorine dioxide and free available chlorine. Many pollutants are found in swimming pool water; trihalomethanes, heavy metals, nitrate, and chlorate.
W86-03520

REMOVAL OF VARIOUS TOXIC HEAVY METALS AND CYANIDE FROM WATER BY MEMBRANE PROCESSES,
Trace Metal Data Inst., El Paso, TX.
L. J. Kosarek.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 261-280, 1 fig, 5 tab, 53 ref.

Descriptors: *Wastewater treatment, *Literature review, *Industrial wastewater, Metals, *Membrane processes, *Cyanide, Reverse osmosis, Ultrafiltration, Filtration, Trace metals, Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Silver, Zinc, Regulations, Public health, Water pollution effects, Water pollution sources, Chelation, Water treatment, *Heavy metals.

This literature review describes the levels, frequency, and regulations associated with the metal and cyanide priority pollutants. The health effects of excess levels, natural background levels, and industrial sources are listed. Membrane processes can economically remove significant proportions of these metals and cyanide from waste streams so that the purified product is usable for recycling or human consumption. These membrane processes include chelation in combination with ultrafiltration, charged ultrafiltration, reverse osmosis, and coupled membrane transport. Reverse osmosis has been documented most frequently with respect to most of the metals. Percent ion rejection varies for the membrane processes, with reverse osmosis having the highest level of removal efficiency. Operating parameters which affect membrane performance are type of membrane, membrane preparation procedure, applied pressure, composition of the raw water, pH, and the quantity of water recovered (both overall and per pass). Membrane fouling and scaling can be minimized by pretreatment to remove suspended solids and microorganisms.
W86-03532

DEMONSTRATION OF A CROSS-FLOW MICROFILTRATION SYSTEM FROM THE REMOVAL OF TOXIC HEAVY METALS FROM

BATTERY MANUFACTURING WASTEWATER EFFLUENTS,
Hydronautics, Inc., Laurel, MD.
N. I. Shapira, H. L. Liu, J. E. Santo, D. Fruman, and C. Darvin.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 281-309, 15 fig, 7 tab, 11 ref.

Descriptors: *Wastewater treatment, *Filtration, Metals, Lead, Hydroperm system, *Heavy metals, Lime, Chemical precipitation, Ultrafiltration, Cross-flow filtration, Battery industry.

The Hydroperm cross-flow microfiltration system was evaluated in laboratory tests and field studies. The system used thickwalled, porous plastic tubes to remove suspended solids from lime-neutralized battery manufacturing wastewater. Toxic heavy metals (specifically lead) in the battery wastewater were reduced to 0.02-0.09 ppm. Fluxes of over 400 gal/sq ft/day were readily attainable. Several advantages of HydroPerm were demonstrated: (1) compactness and versatility in size, (2) ruggedness (unaffected by pH of influent and not subject to fouling and leaking, (3) ease of maintenance, (4) good performance (High flux levels, suspended solids reduction to <5 ppm, suspended toxic metals reduction to <0.1 ppm, sludges of >30% concentration), and (5) suitability of the treated effluent for recycling.
W86-03533

COUPLED TRANSPORT MEMBRANES FOR REMOVAL OF CHROMIUM FROM ELECTROPLATING RINSE SOLUTIONS,
Bend Research, Inc., OR.
K. L. Smith, W. C. Babcock, R. W. Baker, and M. G. Conrod.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 311-324, 7 fig, 1 tab, 14 ref.

Descriptors: *Wastewater treatment, *Industrial wastewater, *Chromium, *Metal finishing wastes, *Membrane processes, Wash water, Coupled transport membranes, Wastewater renovation.

The coupled transport membrane system was used to concentrate chromium for recovery from synthetic electroplating wastewaters. Membranes were formed by immersing a microporous polypropylene membrane in a solvent consisting of 30% by volume of Alamine 336 in an aromatic hydrocarbon diluent. In one experiment reverse osmosis of 5 g per liter of chromium at pH 1.3 produced a concentrated solution of 150 g per liter chromium in 40 g per liter NaOH in 30 hours running time. The final concentration of chromium in the feed solution was 16 ppm; in the product solution, 155,000 ppm, a concentration factor of 9700. The chromium flux was nearly independent of the concentration of chromium in the product solution. Over a 110-day period the flux declined from 54 to 12 micrograms per sq cm per min in 14 days and then increased to a steady flux of about 30 micrograms per sq cm per min in 14 days and then increased to a steady flux of about 30 micrograms per sq cm per min after 50 days.
W86-03534

HYPERFILTRATION OF TEXTILE PROCESS WATER FOR REUSE,
Clemson Univ., SC.
H. G. Spencer, C. A. Brandon, G. Goodman, J. J. Porter, and M. Samfield.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 325-340, 6 fig, 3 tab, 4 ref.

Descriptors: *Wastewater treatment, *Water conservation, *Textile mill wastes, *Membrane processes, Industrial wastewater, Dye industry wastes, Wastewater renovation, Water reuse, Conservation, Filtration, Ultrafiltration, Hyperfiltration, Zirconium oxide membrane.

The pilot study of renovation of wastewater from a production dye range by high temperature hyperfiltration using dynamic zirconium oxide-polyacrylic acid membranes continues to indicate high potential for closed cycle operation by reuse of water and chemicals. The membrane stability, flux and rejection are satisfactory. Simple laboratory reuse tests indicate only a small percentage of the hyperfiltration products may be unsuitable for general reuse as wash water. Judicious planning of the sequence of dyeing processes should permit reconstitution of many hyperfiltration concentrates for reuse in the dye pad. Significant savings (50-70%) of auxiliary components and minor savings of dyes in the concentrate reuse are indicated by the laboratory tests. Reuse of the hyperfiltration products and concentrate obtained with bleach wastewater appear suitable for reuse with savings of wetting agent in the pad formulation. (Author)
W86-03535

REMOVAL OF CHEMICAL CARCINOGENS FROM WATER/WASTEWATER BY REVERSE OSMOSIS,
Abcor, Inc., Wilmington, MA. Walden Div.
W. G. Light.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 341-353, 4 fig, 4 tab, 9 ref.

Descriptors: *Wastewater treatment, *Chemical wastewater, *Carcinogens, *Organic compounds, *Membrane processes, Reverse osmosis, Ultrafiltration, Filtration.

Wastewaters from carcinogen laboratories (from cage washing, dosage, and preparation phases) were treated by reverse osmosis after ultrafiltration to remove suspended solids. The average total organic carbon level in the pilot plant ultrafiltrate from actual wastewaters was 70 mg per liter (range, 15-218 mg per liter). Average removal efficiency was 92.3-92.6%. In bench-scale reverse osmosis studies with synthetic wastewater, removal of individual representative chemicals ranged from 10% to 100%, with an average of 66-72%, depending on the membrane used. Assuming that ultrafiltration removes about 50% of total organic carbon, it was predicted that a combination of ultrafiltration and reverse osmosis would remove a total of 96% total organic carbon and 92% for individual carcinogens. If the original wastewater contained 100 mg per liter of organic compounds, the ultrafiltration-reverse osmosis treatment would remove all but 4 mg per liter of total organic carbon and all but 80 micrograms per liter of carcinogens.
W86-03536

POTENTIAL OF REVERSE OSMOSIS FOR RECYCLING AND REUSE OF SEWAGE EFFLUENTS,
Portsmouth Polytechnic (England). Dept. of Civil Engineering.
B. A. Winfield.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 355-378, 5 fig, 9 tab, 1 app, 27 ref.

Descriptors: *Wastewater treatment, *Membrane processes, *Water reuse, Reverse osmosis, Microorganisms, Organic compounds, Potable water, Agriculture, Nutrient film technique, Ammonia, Nitrates, Activated carbon, Adsorption.

Studies on reverse osmosis treatment of sewage effluents for reuse in industry, agriculture, and as a potable water supply are summarized. Costs of treating sewage effluent are about 1/3 those of treating saline or brackish water. Membrane fouling is independent of turbidity. However, pH of 6.0 produces the lowest rate of flux decline. At higher pH calcium deposits in the fouling layer; at lower pH, electrical charge effects inhibit the flow of ions across the membrane, reducing flux. Use of the concentrated residue for hydroponic growth of vegetables has been demonstrated. Heavy metals uptake in tomatoes is similar to that from plants grown in commercial soil. A model bacteriophage injected into the water was not detectable in the fruit. Some chemicals which are not as easily removed by reverse osmosis are ammonia, nitrate, and organic molecules. Since water for reuse should not contain unacceptable levels of organics such as pesticides, detergents, polynuclear aromatic hydrocarbons, polychlorinated biphenyls, and steroids, additional treatment with activated carbon is desirable. With the combined reverse osmosis-activated carbon system, 98% removal of dissolved organic compounds can be achieved. Bacteria and virus are readily rejected by the membranes. Levels of these microorganisms are reduced by as much as 6 orders of magnitude.
W86-03537

RATIONAL APPROACHES IN THE ANALYSIS OF CHEMICAL DISINFECTION KINETICS,
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Chemical and Environmental Engineering.
C. N. Haas.
IN: Chemistry in Water Reuse: Volume I, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 381-399, 1 fig, 3 tab, 35 ref.

Descriptors: *Wastewater treatment, *Disinfection, *Chlorine, *Kinetics, Model studies, Microorganisms, Mixing, Turbulent flow.

A conceptual model for the analysis of the disinfection process for wastewater was developed. Sample cases included (1) very low chlorine demand and high rate of mixing and (2) a chlorine demand much higher than the chlorine dose and limited mixing. Several conclusions were reached as a result of simulation studies. First, the curves have the declining rate feature often seen in the disinfection of wastewater. Second, even at a very high rate of disinfectant decomposition, substantial inactivation can occur over time intervals greater than the lifetime of measurable chlorine in solution. Third, the ratio of chlorine feed flow to wastewater flow may have a substantial influence on inactivation efficiency. An area of disagreement between model and experimental results was the effect of turbulence on disinfection efficiency.
W86-03538

DISSOLVED AIR FLOTATION FOR PRIMARY AND SECONDARY CLARIFICATION,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
J. G. Henry, and R. Gehr.
Available from Environment Canada, Ottawa, Ontario. SCAT-9, 1981. Canada Mortgage and Housing Corporation, Ottawa, Ontario. 187 p, 27 fig, 39 tab, 11 app, 67 ref.

Descriptors: *Clarification, *Wastewater treatment, *Suspended solids, *Water treatment, *Dissolved air flotation, Flotation, Activated sludge process, Primary wastewater treatment, Secondary wastewater.

A literature survey of over 60 references on the use of dissolved air flotation (DAF) in water and wastewater treatment revealed that, except for flotation thickening, very little information was available on DAF as an alternative to sedimentation. In this study, bench-scale batch and pilot-scale continuous flow dissolved air flotation units were used to clarify raw sewage and mixed liquor from an extended aeration and a conventionally loaded activated sludge plant. Performance parameters, such as effluent and float suspended solids, air to solids ratio, and a 'thickening parameter', of the batch and continuous flow units were compared for scale-up purposes. Comparisons were also made between the performances of the DAF unit when clarifying the three types of feed. The research indicated that batch flotation tests were valuable in predicting full-scale DAF performance. The pilot studies showed that the solids in raw sewage and in the mixed liquor from extended aeration or conventional activated sludge plants could be separated by DAF with efficiencies comparable to those reported for sedimentation. Design criteria for DAF units for each of the three feeds were developed and the costs of utilizing DAF for primary and secondary clarification in municipal plants of 4,500, 45,000 and 227,000 cu m/d capacity were estimated. From an economic point of view, it was found that DAF was not competitive with sedimentation and should only be considered when space is at a premium, land costs are high or when bulking sludges necessitate its use.

W86-03611

WATER AND WASTE MANAGEMENT IN THE CANADIAN MEAT AND POULTRY PROCESSING INDUSTRY,
Dearborn Environmental Consulting Services, Mississauga (Ontario).
For primary bibliographic entry see Field 5E.
W86-03612

STATUS REPORT ON COMPLIANCE WITH THE CHLOR-ALKALI MERCURY LIQUID EFFLUENT REGULATIONS 1978-79,
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
Report No. EPS 3-WP-81-2, March 1981. 14 p, 3 fig, 3 app.

Descriptors: *Mercury, *Water pollution control, *Regulations, *Compliance, *Waste recovery, *Water pollution, Recycling, Water policy, Wastewater treatment, Chlor-alkali plants, Canada.

This report reviews the results of the measures taken by industry and government agencies to curtail mercury losses in liquid effluents from chlor-alkali plants in Canada. Similar status reports were issued for the years 1975 and 1976-1977. Mercury losses to liquid effluents are presently less than 200 kg/yr, a reduction of over 99.5% since 1970. Daily monitoring by companies and periodic monitoring by both federal and provincial environmental agencies have confirmed this reduction. The drastic reduction in mercury purchases and consumption since 1970 is the result of the installation of efficient treatment systems, and increased recovery of mercury from waste gases and solids; ten plants have also terminated production or converted from the mercury to the diaphragm cell process.
W86-03613

DEVELOPMENT OF ETHANOL-SELECTIVE MEMBRANES,
Southern Research Inst., Birmingham, AL.
SoRI-EAS-82-461, Annual Summary Report, June 14, 1982. 62 p, 9 fig, 20 tab, 12 ref. 4789-XIF. sub number: XB-1-9189-3.

Descriptors: *Alcohols, *Water, *Permselective membranes, Chemical properties, Membranes, Membrane filters.

In a 12-month research project, Southern Research Institute has made substantial progress in developing ethanol-selective membranes for use in separating ethanol and water. The general approach in developing such membranes is to combine high selectivity with acceptable strength and low resistance to transfer by forming thin layers of selective material on low-resistance substrates that provide strength. During the 12-month period, it has been shown that this basic approach is promising. It has also been shown that if moieties that have attractive forces for ethanol are fixed to the polymer matrix of the thin layer, the transfer of ethanol molecules is retarded. It was shown by sorption-desorption experiments that different moieties attached to the polymeric matrix have differences in their attractive forces for ethanol, and that variations in the degree of attraction result in changes of selectivity. It was shown that with some polymers, the hydrophobic ends of ethanol molecules apparently were attracted to the polymer chains, and the hydrophilic ends protruded into the spaces between polymer segments. Water molecules intruded and transferred through these spaces. It was also shown that decreasing the distances between polymer segments made it more difficult for water to intrude and thus increased the ethanol selectivity. During the course of the research, three methods of preparing acceptable dual-layer membranes by solution casting and two methods of preparing the membranes by application of monomer systems were developed.
W86-03617

EVALUATION OF BIOLOGICAL NITRIFICATION-DENITRIFICATION AT PENTICTON, BRITISH COLUMBIA,
International Environmental Consultants Ltd., Islington (Ontario).
K. L. Murphy, and R. W. Wilson.
Report SCAT-10, 1981. Canada Mortgage and Housing Corporation, Ottawa, Ontario. 72 p, 13 fig, 13 tab, 33 ref, 2 app.

Descriptors: *Denitrification, *Nitrification, *Municipal Wastewater, *Organic wastes, *Design criteria, Nitrogen removal, Wastewater, Operating costs, Sludge, Wastewater treatment, Activated sludge, Land disposal, Ion exchange.

This study was undertaken to review proven methods for biological nitrogen removal from municipal wastewater, to select suitable design parameters, and to prepare process designs plus capital and operating cost estimates for several process alternatives applicable to the City of Penticton, British Columbia. Process options that were evaluated in detail included two-sludge nitrification plus denitrification, one-sludge post-denitrification and one-sludge pre-denitrification. Process designs were based on achieving a maximum of 5 mg/L N03-N and 1 mg/L TKN in the treated effluent throughout the year, given the raw wastewater characteristics at Penticton. The pre-denitrification process was found to be the most cost effective for Penticton. The design was based on a 20-day solids residence time (SRT) for the nitrification basin and a 10-day SRT for the denitrification basin to ensure efficient nitrogen removal at a minimum operating temperature of 8 C. For Penticton the cost of combined carbon and nitrogen removal by predenitrification was estimated to be approximately 25% greater than for carbon removal by activated sludge and 10% greater than for carbon removal and nitrification alone. Land disposal, ammonia stripping and ion exchange proved to be significantly more expensive than the biological methods of nitrogen removal. The report provides some generalized cost information for nitrogen removal at wastewater treatment facilities ranging in size from 5,000 to 45,000 cu m/d.
W86-03619

STRIPPING KRAFT FOUL CONDENSATES WITH WASTE GASES,
Beak Consultants Ltd., Vancouver (British Columbia).
Report No. EPS 3-WP-82-1, March 1982. Environmental Protection Service, Ottawa, Ontario. Water Pollution Control Directorate. 156 p, 28 fig, 34 tab, 140 ref, 3 append.

Descriptors: *Pulp wastes, *Condensates, *Kraft mills, *Wastwater treatment, *Waste gases, Methanol, Sulfur compounds, Environmental effects, Cost-benefit analysis.

This report presents an assessment of the technical and economic feasibility of using waste gases to strip kraft foul condensates, and an evaluation of the potential effects of this technology on air and water quality. Kraft foul condensates are produced by the condensation of process vapors from digesters and multiple-effect evaporators in kraft pulp mills. Although foul condensates represent only about 5% of pulp mill effluent volume, they are major sources of biochemical oxygen demand, toxicity, fish-flesh tainting, and receiving water taste and odor. The proposed process for stripping kraft foul condensates involves two stages. In the first stage, the foul condesate would be stripped with a small amount of gas to remove the total reduced sulfur (TRS) compounds. In the second stage, the foul condensate would be stripped with a large quantity of waste gas to remove most of the methanol and hence most of the BOD. The off-gas from the methanol stripper, which would contain methanol, ethanol, acetone and guaiacol, would be discharged to the atmosphere. Stripped condensate would be recycled to the process. By stripping foul condensates with waste gases in the proposed process, most of the environmental problems associated with foul condensates could be eliminated, but at a much lower operating cost and a lower degree of process complexity. Capital costs for the two-stage process would be comparable to those for steam stripping.
W86-03624

EVALUATION OF OIL SKIMMERS AND PUMPS,
Environmental Protection Service, Ottawa (Ontario).
For primary bibliographic entry see Field 5G.
W86-03625

PILOT-SCALE ASSESSMENT OF THE BIOLOGICAL FLUDIZED BED PROCESS FOR MUNICIPAL WASTEWATER TREATMENT,
Dearborn Environmental Consulting Services, Mississauga (Ontario).
Report SCAT-11, 1981. Canada Mortgage and Housing Corporation, Ottawa, Ontario. 148 p, 73 fig, 43 tab, 69 ref.

Descriptors: *Fluidized bed process, *Municipal wastewater, *Biological wastewater treatment, *Biofiltration, Pilot plants, Oxidation process, Biologial oxidation, Nitrification, Effluents, Suspended solids.

Pilot-scale investigations of the oxygenic biological fluidized bed process demonstrated that the system is a technically feasible alternative for carbon oxidation and nitrification of municipal wastewaters. A treated effluent containing less than 15 mg/L filterable BOD5 was produced consistently at a loading rate of 10 kg BOD5/cu m.d, an order-of-magnitude higher than typical for conventional suspended growth systems. To attain less than 15 mg/L total BOD5 content, without effluent polishing, required operation at a volumetric loading similar to conventional suspended growth systems, due to the contribution of suspended solids to the final effluent BOD5. The fluidized bed responded rapidly to changes in influent conditions; the process was less susceptible to influent disturbances than the activated sludge and rotating biological contactor processes in terms of effluent filterable organic carbon concentration. There was significant deterioration in effluent quality in terms of suspended solids concentration under diurnally varying flow and concentration conditions. Separate stage nitrification studies did not demonstrate the order-of-magnitude increases in volumetric ammonia oxidation rates claimed by other investigators, primarily because of the relatively low biomass concentrations possible during the treatment of high quality secondary effluent (BOD/TKN<0.4). In addition, diffusional limitations in the reactor biofilms were identified, which significantly increased the reactor hydraulic retention time necessary for low effluent ammonia-nitrogen concentrations (<1 mg/L). The process demonstrated a potential for application in such specific areas as: (1) expanding an existing suspended growth treatment facility; (2) upgrading an existing secondary treatment system to provide nitrification through fludized bed pretreatment for organic carbon removal and/or to provide biological denitrification; and (3) pretreatment of high-strength industrial wastes.
W86-03631

STORMWATER RUNOFF TREATMENT BY IMPOUNDMENT: BARRHAVEN PILOT STUDY,
R. J. Gietz.
Report SCAT-8, 1981. Canada Mortage and Housing Corporation, Ottawa, Ontario. 72 p, 27 fig, 7 tab, 2 app, 17 ref.

Descriptors: *Storm water, *Storm runoff, *Reservoirs, *Runoff volume, Runoff rates, Basins, Suspended solids, Coliforms, Streptoccus, Bacteria, Organic compounds.

This report presents the findings of a two-year study of stormwater runoff treatment by impoundment in an open basin. The treatment system was operated as a batch process for one summer and as a continuously overflowing pond for another. Runoff from 866 ha of agricultural and residential suburban lands partly under construction entered the treatment system. Impoundment reduced pollutant loadings by over 90% for suspended solids, 75%-90% for bacteria (total and fecal coliform and fecal streptococcus) and 25%-50% for organic nitrogen and total phosphorus compounds when the

runoff could be stored for more than 12 hr. At least 5 mm of rainfall were required to produce measurable runoff. The ratio of runoff to rainfall was used to estimated the runoff volumes that would be generated by up to 25-year return frequency storms of one and two-hour durations. From this, a storage volume of 40,000 to 47,000 cu m was indicated, on the basis of containment of runoff from a ten-year storm. It was determined that the most effective method of operating the treatment system was to keep the reservoir drawn down to a shallow pond. When runoff entered the pond, the drain valve was closed and the treatment system filled. Where possible, the runoff volume would be contained until its quality was suitable for discharge. For runoff volumes exceeding the treatment system storage volume, discharge took place over the spillway with limited pollutant removal. When the effluent quality became satisfactory, the reservoir was drained to the original shallow pond, and dry weather flow allowed to pass through. Other factors that govern the choice of treatmnt system storage volume are the runoff event frequency and the allowable discharge rate. It was found that of the approximately 30 events that could be expected from May to September about half took place within four days of one another. Allowing one day to fill and one day for storage, the reservoir should require two days to empty.
W86-03632

WASTEWATER TREATMENT SYSTEM FOR A LURGI COAL GASIFICATION PLANT,
ANG Coal Gasification Co., Detroit, MI.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-015765, Price codes: A18 in paper copy, A01 in microfiche. DOE/RA/20225-T3, February 15, 1982. Department of Energy, Washington, DC. 412 p, 16 fig.

Descriptors: *Wastewater facilities, *Wastewater treatment, *Industrial wastewater, *Waste disposal, *Oily water, *Coal gasification, Phenols, Ammonia, Cooling towers, Flotation, Lurgi gasification plant, Incineration, Storm wastewater, Lignite, Sludge disposal, Water reuse, Brine disposal, Wastewater disposal, Landfills, Land disposal, Wastewater lagoons, Injection wells, Boiler water, Phenosolvan unit, Phosam unit.

A wastewater treatment plant for a Lurgi gasification plant processing 14,000 tons of North Dakota lignite per day is described. The plant has multiple wastewater sources and treatment processes. Surface runoff containing normal quantities of sediment is controlled in a drainage ditch with capacity for a 100-year storm. Clean inplant storm drainage goes to three retention ponds, which allow suspended particles to settle and oily water to be pumped to the oily water treatment system. Sanitary waste is treated in a 20,000 gal per day package unit, which includes biological oxidation, clarification, and chlorination. Wastewater, after secondary treatment, is discharged to the stormwater pond; sludge is used as a soil conditioner. Inorganic wastewater from filter backwashing and ion exchange resin regeneration is recycled to the primary water treatment system; excess good-quality wastewater, brine solutions, and blowdown are injected into a deep well. Pretreatment for injection includes filtration and pH adjustment. Oily water drainage, collected from various operating units, enters a splitter box, parallel APR separators, and flotation unit. Gasification liquor, containing tar, tar oil, coal dust, phenols, ammonia and other compounds, is the largest single wastewater stream in the plant. After cooling, the gas liquor is separated into tar-coal dust, water, and tar oil fractions. Phenols are removed by diisopropyl ether extraction. Ammonia and acid gases are treated in a Phosam Unit, which absorbs wastes in ammonium phosphate solution. Concentrated waste liquor is incinerated. Hazardous wastes are placed in an onsite landfill.
W86-03639

PROCEEDINGS OF THE 6TH SYMPOSIUM ON WASTEWATER TREATMENT,
Department of the Environment, Ottawa (Ontario).
November 16-17, 1983, Montreal (Quebec). 331 p.

Descriptors: *Symposium, *Wastewater treatment, *Sludge disposal, *Sludge utilization, *Anaerobic digestion, *Industrial wastewater, *Biological wastewater treatment, *Municipal wastewater, Biodegradation, Wastewater facilities, Settling basins, Activated sludge, Alum, Organic compounds, Tertiary wastewater treatment, Macrophytes, Slime, Water pollution control.

This symposium was organized to allow scientists, engineers, technicians, plant operators and specialists working in research, design and operation of wastewater treatment facilities to promote and share their expertise and techniques in the municipal or industrial wastewater treatment fields. Guest speakers from a variety of specialties and countries presented papers on such topics as biological oxidation, anaerobic pretreatment, sludge disposal and utilization, pulp and paper industry wastewater treatment, analysis and treatment of toxic organics, filterable solids, clarifiers and batch reactors for municipal plants. Other topics included control of alum addition, removal of particles in settling basins, anaerobic digestion systems, use of aquatic macrophytes for sludge treatment, design of activated sludge processes, pollution control, and slime growth on fine bubble diffusers. A total of 25 papers were presented, 9 in French and 16 in English.
W86-03659

POLYSAR BIOLOGICAL OXIDATION TREATMENT PLANT,
Polysar Ltd., Sarnia (Ontario).
E. R. Fioroni.
In: Proceedings of the 6th Symposium on Wastewater Treatment, November 16-17, 1983, Montreal (Quebec). p 1-25, 2 fig.

Descriptors: *Wastewater facilities, *Aeration, *Biological wastewater treatment, *Education, *Training, *Design criteria, *Pilot plants, *Wastewater treatment, Wastewater renovation, Waste recovery, Recycling, Aerators, Sludge utilization, Clarification.

The Polysar plant was designed to centrally treat industrial waste streams before discharge into the St. Clair River as part of the overall program to improve the water quality of Great Lakes. The Marshall Macklin Monaghan Limited was awarded the design of the Biox Plant in July 1980. A 'fast track' approach was adopted which called for good communications between Polysar and Marshall Macklin Monaghan. A liason office was established for the Polysar project team at the designer's Don Mills Office. The design and construction process took two and one-half years and the whole project was delivered at 10% under budget. The major process components of the Biox Plant consist of pre-treatment, pre-aeration/equalization, aeration, clarification, and sludge return. Some effluents are pre-treated to remove oil and rubber which are reclaimed for other uses. The jet aeration system, a type of deep tank system, was chosen for the Biox plant. Three blowers are housed in a separate building next to the aeration tanks. An extensive training program consisting of pre-start-up training, start-up training and post-start-up training was undertaken. The plant started up in December 1983 and after 10 days met the Ministry of the Environment requirements for phenolics and total organic carbon.
W86-03660

ANAEROBIC PRETREATMENT FACILITY ALSO PROVIDES SLUDGE DISPOSAL CAPABILITY AND SOURCE OF RENEWABLE ENERGY FOR FOOD PROCESSOR,
ADI Ltd., Fredericton (New Brunswick).
R. C. Landine, C. J. DeGarie, A. A. Cocci, A. L. Steeves, and G. J. Brown.
In: Proceedings of the 6th Symposium on Wastewater Treatment. November 16-17. 1983. Montreal (Quebec). p 26-45, 8 fig, 4 tab.

Descriptors: *Fermentation, *Wastewater facilities, *Wastewater treatment, *Food-processing wastes, *Waste recovery, *Recycling, *Sludge utilization, *Methane, Industrial wastes, Chemical oxygen demand, Biological oxygen demand, Suspended solids, Nitrogen, Operating costs, Anaerobic conditions.

A waste treatment facility for a potato processing plant in France was constructed which consists of a raw waste pumping station, vibrating screens, potato waste hoppers, ADI-BVF (anaerobic fermenter), aeration nitrification complete with clarifier and sludge return, control building and ancillaries including biogas handling equipment and automatic samplers. Phase I of the facility has been operating since August 1981. The anaerobic portion of the plant (an ADI-BVF) provides over 90% removal of BOD, COD, and SS while operating under higher loadings than assumed for design and at temperatures below 20 degrees. The ADI-BVF operates without any addition of chemicals or heat. Primary and secondary sludges are disposed in the ADI-BVF where they are anaerobically decomposed to enhance biogas production. After two years of operation, no sludge has been removed from the facility. Recovered biogas is used in the factory boilers to make process steam. Overall removals for COD, BOD, SS and total N were 98%, 99.5%, 98%, and 80%, respectively. The entire facility was economical to construct and required only two operators. The monetary value of the biogas recovered exceeds all the operating costs plus labor costs.
W86-03661

FILTRABLE SOLIDS AS A DESIGN PARAMETER FOR WASTEWATER TREATMENT PROCESSES,
California Univ., Davis. Dept. of Civil Engineering.
G. Tchobanglous, A. D. Levine, and J. R. Koltz.
In: Proceedings of the 6th Symposium on Wastewater Treatment, November 16-17, 1983. Montreal (Quebec). p 68-87, 6 fig, 5 tab, 7 ref.

Descriptors: *Particle size, *Filtration, *Membrane filters, *Wastewater treatment, *Suspended solids, *Sedimentation, *Wastewater composition, *Trickling filters, Separation techniques, Membrane processes, Biochemical oxygen demand, Primary wastewater treatment, Case studies.

Evidence is presented to suggest that the use of the mass distribution of filtrable solids is an appropriate and practical measure to provide a more useful characterization of wastewater than suspended solids (SS) or biochemical oxygen demand (BOD) for the design of wastewater treatment processes. The performance of biological treatment processes can be enhanced through the removal of SS larger than 1 micron in particle size. Particle sizes greater than 1 micron could be removed by chemical additions to the incoming wastewater or by mechanical filtration using the pulsed-bed filter. Techniques for measuring particle sizes in water and wastewater include electronic, light scattering, microscopic, flow fractionation, sedimentation or filtration methods. The mass distribution of filterable solids was determined using Nucleopore polycarbonate membrane filters, and scanning electron microscopy of samples collected from the various size filters. Samples from four surface waters and five wastewater treatment plants were examined for solids characteristics. The distribution of filterable solids in lake and river water varies with the time of year and that of wastewater varies with the time of day. A case study was performed of the treatment of a filtered primary effluent subjected to a pulsed-bed filter and a tower trickling filter. Results suggest that a high quality effluent can be achieved by chemical treatment if larger particles are removed early in the treatment process.
W86-03662

WATERLOO CLARIFIER: PRINCIPLES AND PRACTICE,
Waterloo Univ. (Ontario). Dept. of Chemical Engineering.
R. R. Hudgins, and P. L. Silveston.
In: Proceedings of the 6th Symposium on Wastewater Treatment, November 16-17, 1983, Montreal (Quebec). p 113-122, 8 fig, 12 ref.

Descriptors: *Wastewater treatment, *Clarifiers, *Clarification, *Suspended solids, *Internal waves, *Separation techniques, *Primary wastewater treatment, *Baffles, Waves, Wave action, Wave height, Secondary wastewater treatment.

Research has suggested that density fluctuations or internal waves in clarifiers are responsible for removal efficiencies well below those theoretically possible and that these naturally initiated fluctuations can be controlled by baffles designed to function as wave traps. Experiments conducted in 4-ft and 8-ft diameter model circular clarifiers show that baffles reduce low frequency wave amplitudes and substantially improve the solids removal. Research at the Waterloo University have concentrated on flushing internal waves out of the clarifier. In the Waterloo Clarifier, the vertical walls are replaced by sloping ones. For the circular clarifier, the walls take the form of a truncated, inverted cone. For the square clarifier, the walls become a truncated, inverted pyramid while for the rectangular clarifier, only the wall at the outlet is sloped. Performance tests indicate that the Waterloo clarifier is capable of suspended solids reductions both in primary and secondary clarification exceeding conventional clarifiers of the same surface area. Although cost savings should be appreciable with the new design, it must be tested in full-scale operation.
W86-03663

IMPLEMENTATION OF SEQUENCING BATCH REACTORS FOR MUNICIPAL WASTEWATER TREATMENT,
Municipal Environmental Research Lab., Cincinnati, OH. Wastewater Research Div.
E. F. Barth.
In: Proceedings of the 6th Symposium on Wastewater Treatment, November 16-17, 1983, Montreal (Quebec). p 123-143, 7 fig, 4 tab, 17 ref.

Descriptors: *Wastewater treatment, *Municipal wastewater, *Phosphorus removal, *Industrial wastes, *Separation techniques, *Sequencing batch reactors, Nitrification, Denitrification, Dairy industry, Pilot plants, Cost analysis, Comparison studies.

Sequencing batch reactor (SBR) technology is being implemented at various municipal sites both in the U.S. and abroad. Total life-cycle cost savings, ease of operation and reliability favor this technology at facilities sized up to 19,000 cu m/day. SBR allows control to be exerted over substrate tension in the reactor. SBR also requires no recycle pumping and liquid solids separation occurs under near ideal quiescent conditions. A three tank SBR system is considered near optimum for flows above 3,785 cu m/day. For such a system, automated valving and a process controller which eliminates major labor times is recommended for small facilities. Current research investigations on SBR's concern controlling sludge settleability, nitrification-denitrification, and biological phosphorus removal. SBR technology is being applied to the treatment of dairy wastes at the Springfield Creamery in Oregon, the treatment of a combination of landfill leachate and chemical manufacturing wastes in Niagara, New York and the upgrading of the Culver, Indiana continuous flow activated sludge facility. SBR studies on two wastewaters have not as yet revealed the controlling parameters to insure consistent, highly reliable biological phosphorus removal.
W86-03664

APPLICATION OF BIOLOGICAL BATCH REACTOR TECHNOLOGY IN WASTEWATER TREATMENT,
Schmidtke (Norbert W.) and Associates Ltd., Kitchener (Ontario).
N. W. Schmidtke, and B. H. Topnik.
In: Proceedings of the 6th Symposium on Wastewater Treatment, November 16-17, 1983, Montreal (Quebec). p 144-158, 14 fig, 1 tab, 12 ref.

Descriptors: *Batch reactors, *Wastewater treatment, *Suspended solids, *Performance evaluation, *Biochemical oxygen demand, *Biological wastewater treatment, *Domestic wastes, *Municipal wastewater, Phosphorus removal, Canada, Aeration, Industrial wastes, Seasonal variation, Nitrogen, Cost analysis.

Until recently, biological batch reactors had been relegated to the laboratory for process design data generation. Batch reactors are now being used at full scale in a variety of operational modes, especially in the treatment of domestic wastewaters. A batch reactor in Canada was involved in the retrofitting of a 9 cu m/day extended aeration plant designed to handle the flow from 5 residences at the Glenlea Agricultural Station just outside the city of Winnipeg. Long term performance of the batch reactor produced a superior quality effluent as defined by BOD(5)=5 mg/L, SS=5.5 mg/L and NH3-N=2.5 mg/L. Reductions in total phosphorus without use of chemical precipitants exceeded 50%. These observations confirm that the proper application of biological batch reactor systems is simple, inexpensive, requires a minimum of operator skill and attention, yet produces an effluent with characteristics normally associated with more complex biological treatment systems. Batch reactors would prove an attractive treatment option in situations where seasonal, and/or high strength wastes from municipalities, resorts and industry require a quick, reliable, and cost-effective solution.
W86-03665

ALKALINITY FEED FORWARD CONTROL OF ALUM ADDITION IN WASTEWATER TREATMENT,
Norsk Inst. for Vannforskning, Oslo.
T. Damhaug, and B. Paulsrud.
In: Proceedings of the 6th Symposium on Wastewater Treatment, November 16-17, 1983, Montreal (Quebec). p 159-165, 6 fig, 5 ref.

Descriptors: *Phosphorus removal, *Automation, *Control systems, *Wastewater treatment, *Alum, *Alkalinity, *Conductivity, *Chemical precipitation, Chemical treatment, Monitoring, Phosphorus, Hydrogen ion concentration.

An alternative concept of alum addition based on feedforward control is proposed for wastewater treatment systems that practice phosphorus removal to control eutrophication of surface waters. The control method requires an alkalinity measuring device which is recorded indirectly from the conductivity parameter. Such feedforward control devices were adopted by a Norwegian primary-chemical treatment plant that had been experiencing problems with alum dosing. A follow-up study showed that effluent pH was kept nearly constant (6.4-6.6) over the flow range even though alum dosage varied between 60 and 300 g/cu m, indicating the efficiency of the control system. An overall increase of total phosphorus removal efficiency from 96 to 99% was also recorded. By changing to automatic feedforward control, the average alum consumption was reduced from 270 to 190 g/cu m. The need for manual corrections is reported to be negligible.
W86-03666

COMPUTATION OF FRACTIONAL REMOVAL OF DISCRETE AND FLOCCULANT PARTICLES IN SETTLING BASINS,
Windsor Univ. (Ontario). Dept. of Civil Engineering.
S. K. Agrawal, and J. K. Bewtra.
In: Proceedings of the 6th Symposium on Wastewater Treatment, November 16-17, 1983, Montreal (Quebec). p 182-189, 4 fig, 4 ref.

Descriptors: *Wastewater treatment, *Flocculation, *Particle size, *Suspended solids, *Settling velocity, *Mathematical studies, *Theoretical analysis, *Mathematical models, Solid wastes, Sedimentation, Settling basins, Chemical coagulation, Settling tanks, Particulate matter.

In the conventional method of calculating the fractional removal of flocculant particles, it is assumed that the average settling velocity for different particle sizes in the lower depths in settling basins is the same as in the upper depths. This assumption is not quite correct, because the particles continuously flocculate and/or shear during the entire settling depth, and hence the average settling velocity changes both with depth and time. In the modified method, a different approach for calculating the fractional removal of particles is proposed to overcome the deficiency in the conventional method. Instead of considering a vertical constant time line, a more reasonable horizontal constant depth line for that particular time is used. This approach is more reasonable because the settling velocities of different flocculating particles are all averaged over the same depth. A typical example has been worked out to illustrate the applications of both the methods. (Author)
W86-03667

COMPARISON OF STIRRED SUSPENSION AND FIXED FILM ANAEROBIC DIGESTION SYSTEMS,
Waterloo Univ. (Ontario). Dept. of Chemical Engineering.
P. W. Girard, J. M. Scharer, and M. Moo-Young.
In: Proceedings of the 6th Symposium on Wastewater Treatment, November 16-17, 1983, Montreal (Quebec). p 230-260, 10 fig, 15 tab, 32 ref.

Descriptors: *Wastewater treatment, *Anaerobic digestion, *Comparison studies, *Cellulose acetate, *Biological wastewater treatment, *Models, *Methane, *Economic feasibility, Anaerobic conditions, Biodegradation, Model studies, Animal wastes, Industrial wastes, Pulp wastes.

The techno-economic feasibility of two-stage anaerobic digestion systems for the treatment of cellulosic wastes was investigated. In the first stage, the enzymatic hydrolysis of insoluble substrates was the rate limiting step. Optimum cellulose hydrolysis and conversion to volatile acid products was observed at C:N ratio of 24:1. Fixed film and stirred tank reactors were utilized to study methanogenesis. The kinetics of volatile fatty acid utilization was proven to be rate limiting. Acetate utilization by methanogens followed a Monod-type kinetic model; the maximum specific growth rate and the half saturation constant were found to be 0.17/day and .00846 M acetate, respectively. Propionate utilization, however, was strongly inhibited by acetate. The inhibition resembled classical competitive inhibition patterns, the inhibition constant being 2.97 times 10 to the minus 7th power M. The models derived for volatile acid substrates were applicable for acid mixtures in both stirred tank and downflow fixed film reactors. The economic feasibility of the anaerobic digestion systems has been performed concurrently with the experimental program. In the analysis, capital equipment costs were based on quotations from manufacturers. Scale-up was based on procedures generally used by the food and fermentation industry. Process economics favored fixed film biological reactors. A particularly attractive scenario was the co-digestion of paper pulpmill clarifier sludges with animal wastes. Using a C:N ratio of 24:1 in the feed, a fuel gas containing 72% methane was predicted and the process would be economically feasible at moderate installation sizes. (Author)
W86-03668

USE OF AQUATIC MACROPHYTES FOR SLUDGE TREATMENT,
Foundation Trust Ltd., Salzburg (Austria).
G. A. Neurohr.
In: Proceedings of the 6th Symposium on Wastewater Treatment, November 16-17, 1983, Montreal (Quebec). p 262-279, 2 fig, 9 tab, 15 ref.

Descriptors: *Wastewater treatment, *Macrophytes, *Sludge drying, *Sludge thickening, *Dewatering, *Biodegradation, *Digested sludge, *Sludge bed, Biomass, Metabolism, Biotransformation, Composting.

Modified sand-based sludge drying beds planted with emergent reeds of Phragmites communis (reed beds) are being used to improve the dewatering capability of conventional sludge drying beds without the use of chemicals or any subsequent energy intensive handling or processing tech-

niques. Aerobic stabilized sludge is pumped directly from the aeration basins to the reed beds where it undergoes air drying. Sludge is kept on the reed beds until secondary roots and shoots are able to assist in decomposing the sludge residue by means of bacterial and plant metabolism in the rhizosphere of Phragmites communis. The bed turnover time is at least 5 yr. The oldest field scale plant at the Ustersbach plant in Germany employs 300 sq m of reed beds and has been operating intermittently for 8 yr without removing the humus build-up. In Southern Germany about 20 dryings of 8-12 cm of wet digested sludge are feasible per year on open beds. If the site is protected from rain by enclosures, the number of dryings could be increased by 30-70%. The advantages of reed beds over conventional facilities lie in the long bed turnover time and in the byproducts (biomass and low grade compost) produced.
W86-03669

FUNCTIONAL DESIGN OF ACTIVATED SLUDGE PROCESSES,
Delaware Univ., Newark. Dept. of Civil Engineering.
A. F. Gaudy, and A. F. Rozich.
In: Proceedings of the 6th Symposium on Wastewater Treatment, November 16-17, 1983, Montreal (Quebec). p 280-297, 7 fig, 1 tab, 10 ref, 3 append.

Descriptors: *Model studies, *Mathematical models, *Design criteria, *Activated sludge process, *Mathematical equations, *Waste characteristics, *Organic matter, *Effluents, Activated sludge, Models, Computer models, Computer programs, Organic compounds.

A design and operational model for normal wastes and for waste containing toxic organic substrates is described. The model is used to predict effluent quality and sludge production which are governed by waste strength, biokinetic constants, and three selectable engineering control parameters. The interrelationship of all of these factors determines plant efficiency. The Monod relationship describes the relationship between soluble organic pollutants remaining after treatment and the specific growth rate of the biomass on noninhibitory substrates while the Haldane equation describes this same relationship for the growth of heterogeneous microbial populations on inhibitory or toxic substrates. The engineering model is most adaptable as a subroutine for economic or costing models because the parameters are easily manipulated to optimize design and operation costs for a given degree of treatment. It is easily manipulated by plant personnel to guide operation of the system. A computational example of the use of the model is given along with a sample computer program in BASIC to facilitate computations on the hand-held microcomputer.
W86-03670

POLLUTION CONTROL: THE HIDDEN PROFIT CENTRE,
Rupke and Associates Ltd., Bradford (Ontario).
J. W. Rupke.
In: Proceedings of the 6th Symposium on Wastewater Treatment, November 16-17, 1983, Montreal (Quebec). p 298-301, 1 tab.

Descriptors: *Food-processing wastes, *Case studies, *Wastewater treatment, *Cost analysis, *Activated sludge, *Sludge utilization, *Sludge thickening, *Phosphorus removal, Water pollution sources, Industrial wastes, Food processing industry, Industrial plants, Sludge disposal, Aeration lagoons, Sludge bed, Sludge drying, Water pollution control.

In many cases, the close scrutiny of pollution sources can identify raw and final product losses of such a magnitude that the savings obtained in the production facility more than offset the costs of pollution control. To illustrate this point a case history of a food processor operating a 200 cu m/day activated sludge system followed by an aerated lagoon and two stabilization ponds is examined. The regulatory agency was concerned about odors from the industry's aerated lagoon being used for waste activated sludge stabilization and storage. In the first year, minor piping and operational changes allowed more sludge solids to be generated from the thickener, resulting in a more acceptable cattle feed product. The aeration system was found to be of sufficient capacity that only one aeration tank was needed during periods of lower production. The food processing industry has also been able to treat the waste stream of an adjacent company at a profit. Phosphorus discharge was reduced by careful monitoring of a phosphate spray step and capture of the overspray. The use of professional operators helped to maximize the use of existing equipment and delay or remove the need for further capital expenditures.
W86-03671

SLIME GROWTH ON FINE BUBBLE DIFFUSERS,
Gore and Storrie Ltd., Toronto (Ontario).
G. Addison.
In: Proceedings of the 6th Symposium on Wastewater Treatment, November 16-17, 1983, Montreal (Quebec). p 302-322, 14 tab, 9 photos.

Descriptors: *Bubbles, *Aerators, *Slime, *Hydraulic equipment, *Biochemical oxygen demand, *Fouling, *Wastewater treatment, *Performance evaluation, Water pollution control, Aeration, Hydraulic machinery, Biological oxygen demand, Dissolved oxygen, Pilot plants, Aeration lagoons, Model studies.

Pilot studies were conducted at the Lakeview Water Pollution Control Plant (WPCP) in Ontario to determine whether fine bubble diffusers would slime when used to treat sewage. As a result of the testing at Lakeview it was concluded that sliming can be expected on fine bubble diffusers when they are installed at the inlet zone of the plug flow aeration tank. Sliming is not expected at the end of a plug flow aeration tank as long as soluble BOD5 remains below approximately 15 mg/L. Sliming can be expected to about the halfway point of an aeration tank at the Lakeview WPCP. Headloss increases that occur appear to be from air side fouling or inorganic compound build-up rather than slime growth. Formic acid cleaning lessens but does not eliminate sliming of diffusers. It is recommended that the limits of soluble BOD under which diffusers can be operated without problems be identified and that satisfactory operation of bubble diffusers on a pilot scale be demonstrated to confirm that factors other than soluble BOD concentrations have no significant effects with respect to sliming.
W86-03672

AQUACULTURE IN DREDGED MATERIAL CONTAINMENT AREAS: PROCEEDINGS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 2H.
W86-03704

PROCEDURES AND PRACTICES IN ACTIVATED SLUDGE PROCESS CONTROL.
Activated Sludge Process Control Series, Butterworth, Boston. 1983. Edited by Robert M. Arthur. 226 p.

Descriptors: *Wastewater treatment, *Activated sludge process, *Process control, *Design criteria, *Computers, Biological wastewater treatment, Sludge, Training.

Several aspects of process control in activated sludge systems were discussed in a conference by invited speakers. Correlation of process control with effluent BOD and suspended solids is possible if growth of floc-forming bacteria is maintained. Only three basic processes can be controlled. These are aeration, return sludge rate, and sludge wasting. The use of analytical data in process control is explained with sample reporting forms. Two papers concern computerization of process control. On-line oxygen uptake rate determined by respirometers allows rapid implementation of process changes. Activated sludge plants can be designed for ease of operation; practical suggestions, emphasizing flexibility, are presented. Employee training is an important part of process startup.
W86-03727

CORRELATION OF PROCESS CONTROL STRATEGIES WITH EFFLUENT BOD AND SUSPENDED SOLIDS,
California Univ., Davis. Dept. of Civil Engineering.
D. E. Schroeder.
In: Procedures and Practices in Activated Sludge Process Control, Butterworth, Boston. 1983. p 1-23, 6 fig, 4 tab, 3 ref.

Descriptors: *Wastewater treatment, *Activated sludge process, *Process control, Biological wastewater treatment, Design criteria, Sludge, Organic loading, Equalizing, Dissolved oxygen, Oxygenation, Chemical coagulation, Flocculation, Baffles, Suspended solids, Model studies, Statistical analysis.

The steady state is an unachievable goal in biological wastewater treatment, which should be viewed as an inherently unstable process. Three factors are responsible for this--variation in input, sequencing in microbial population dominance, and sensitivity to temperature. The objectives of process control in the activated sludge process are (1) damping out of input variations, (2) minimization of effluent variation, and (3) prevention and recovery from process upsets. The following control strategies are in common use in activated sludge plants (with the exception of trickling filters): sludge age/wasting, loading rate, flow equalization, change in process configuration, recycle, dissolved oxygen, and chemical addition. Although mathematical models can be used to determine design values for oxygen uptake rates, sludge production, and filtered effluent BOD, they are not helpful in estimating actual effluent quality because that value is dominated by suspended solids. Two preventive and long-term strategies are available for controlling effluent BOD and suspended solids: matching process configuration with wastewater characteristics and use of statistical tools for determination of inherent problems. Factors to be considered in process control are pinpoint floc, dispersed growth, filamentous bulking, and hydraulic instabilities. The best control operates in the conventional solids retention time range and incorporates a non-carbon-limited region into the system. Baffling can accomplish this.
W86-03728

PROCESS CONTROL STRATEGIES,
Arthur Technology, Inc., Fond du Lac, WI.
R. M. Arthur.
In: Procedures and Practices in Activated Sludge Process Control, Butterworth, Boston. 1983. p 25-45, 10 fig, 6 ref.

Descriptors: *Wastewater treatment, *Activated sludge process, *Process control, Biological wastewater treatment, Sludge, Aeration.

In a conventional activated sludge plant only three variables can be controlled: rate of aeration, rate of return sludge, and rate of wasting. The best way to vary aeration is to use several blowers of different sizes so that the optimum combination may be used at given conditions. Close control may be achieved by (1) a feedback system in which dissolved oxygen changes are used to indicate changes in oxygen requirements or (2) use of respiration rates to indicate the actual oxygen demand. Although the rate of sludge return should be controlled, it is difficult. However, respiration rates can be used to indicate the food: microorganism ratio. Return pumps can also be set to work at a given sludge blanket level height. To prevent anoxic conditions the detention time of the sludge can be matched with the time it takes for the dissolved oxygen to equal zero or to monitor the oxidation reduction potential. Sludge wasting can be controlled by determining the ratio of endogenous rate of respiration of the sludge to the concentration of mixed liquor volatile suspended solids. In some plants raw wastewater storage or microorganism storage can be effectively used in process control.

W86-03729

UNDERSTANDING THE APPLICATION OF ANALYTICAL DATA TO PROCESS CONTROL,
Operating Consultant Services, Cincinnati, OH.
T. J. Lutcher, and G. E. Ettel.
In: Procedures and Practices in Activated Sludge Process Control, Butterworth, Boston. 1983. p 53-64, 3 fig, 7 ref.

Descriptors: *Wastewater treatment, *Activated sludge process, *Process control, Biological wastewater treatment, Performance evaluation, Monitoring, Chemical analysis, Microorganisms.

Analytical data can be used in activated sludge process control. Typical tests providing performance data are temperature, pH, dissolved oxygen, mixed liquor suspended solids, mixed liquor volatile suspended solids, solids settling rate, alkalinity, nutrients, oxygen uptake rate, and viability of microorganisms. Before choosing tests for a monitoring program several factors must be considered: limitations of the procedure, similarity between test conditions and process conditions, test interferences, sample degradation, meaning of the end result, and type of sample (grab, composite, on-line). Sample forms for recording test results are illustrated. If test results indicate that a process parameter is out of control, the required adjustment must be communicated accurately to others involved. The necessary process change is then implemented, allowing sufficient time for the biological processes to respond.
W86-03730

COMPUTERIZATION: CAN IT WORK FOR YOU,
Thorn Creek Basin Sanitary District, Chicago Heights, IL.
R. A. Davis.
In: Procedures and Practices in Activated Sludge Process Control, Butterworth, Boston. 1983. p 77-85.

Descriptors: *Wastewater treatment, *Activated sludge process, *Process control, *Computers, Biological wastewater treatment, Performance evaluation, Monitoring, Thorn Creek Basin, Automation, Data processing.

Computerization is useful in wastewater treatment plant process control. Cost savings result from increased efficiency in using equipment and personnel. Reports are available within minutes instead of days, improving the quality and consistency of effluent quality. However, all personnel should understand how to perform all procedures and calculations manually in case of system failure. Programming should allow flexibility to account for changes in technology and requirements. Experience in computer installation and operation in the Thorn Creek Basin Sanitary District (Chicago, Illinois) advanced wastewater treatment plant are related. Here direct control has been used successfully for flow equalization, pump related. Here direct control has been used successfully for flow equalization, pump operation, and blower control. In addition, flow control, digester performance, and utility consumption efficiency have been improved. Computerization has not yet proved usable in chlorination control and raw sludge pumping. Maintenance of the computer system is protected from the ever-present high moisture and hydrogen sulfide, which can attack electronic circuitry. Power fluctuations have wiped out the entire disk and have caused all processes to switch to manual control. This problem has been partially alleviated by installation of an uninterruptible power supply. Sensors, the weakest link in the control loop, must be constructed to work reliably and must be maintained and calibrated regularly.
W86-03731

COMPUTER AS A TOOL FOR ACTIVATED SLUDGE,
EMA, Inc., St. Paul, MN.
R. G. Skrentner.
In: Procedures and Practices in Activated Sludge Process Control, Butterworth, Boston. 1983. p 87-111, 12 fig, 11 ref.

Descriptors: *Wastewater treatment, *Activated sludge process, *Process control, *Computers, Biological wastewater treatment, Performance evaluation, Monitoring, Flow control, Flow measurement, Automation, Data processing, Sludge, Aeration, Dissolved oxygen, Oxygenation.

Computers can provide not only basic control, but optimized control, in an activated sludge plant. Converting from basic to optimized control involves developing a way of measuring the characteristics of the process, improving efficiency and stability with less operator involvement, and formulating predictive models to correct possible problems. Detailed information is provided to computerize flow measurement/control, sludge handling/distribution, and dissolved oxygen or air systems. Practical suggestions include borrowing or leasing instruments for testing and evaluation and becoming knowledgeable about the capabilities of a computer control system.
W86-03732

RELATING BOD5 WITH ON-LINE OXYGEN UPTAKE RATE MEASUREMENTS USING AUTOMATIC RESPIROMETERS IN VIEW OF PROCESS MONITORING AND CONTROL,
Sherbrooke Univ. (Quebec).
N. Therien, and F. Ilhan.
In: Procedures and Practices in Activated Sludge Process Control, Butterworth, Boston. 1983. p 113-129, 10 fig, 4 tab, 9 ref.

Descriptors: *Wastewater analysis, *Activated sludge process, *Process control, *Respirometers, *Biochemical oxygen demand, Biological wastewater treatment, Monitoring, Automation, Oxygen uptake.

Automatic respirometers were used to relate specific oxygen uptake rate to the BOD5 of domestic and industrial wastewater. A linear relationship was observed when biomass is not limiting the substrate assimilation process. A Michaelis-Menten formulation fit the data well and produced reliable BOD5 estimates even when biomass influenced the substrate assimilation process. Typically the predicted BOD5 value of influent was obtained within 30 min. This information was then put into a system which controlled the activated sludge process.
W86-03733

DESIGN OF ACTIVATED SLUDGE FACILITIES FOR OPERATING AND MAINTAINABILITY,
Smokey Stack, Inc., Cedars, PA.
V. T. Stack.
In: Procedures and Practices in Activated Sludge Process Control, Butterworth, Boston. 1983. p 131-152, 3 fig.

Descriptors: *Wastewater treatment, *Activated sludge process, *Process control, *Design criteria, Flexibility, Biological wastewater treatment, Maintenance, Equalizing, Pretreatment of wastewater, Screens, Clarification, Aeration basins, Sludge, Chlorination, Chemical treatment, Pipes, Sampling, Measuring instruments.

The operator of an activated sludge plant generally recognizes the need for process flexibility more than the other parties involved in plant design: owner, engineer, and regulatory agencies. Flexibility generally adds 25%-40% to capital costs. For adequate flexibility the processes should be designed for the proper number and capacity of parallel units and for several modes of operation including plug flow, complete-mix, step feed, and contact stabilization. In pretreatment, operations and maintenance are easier with equalization, three parallel grit removal units, and three parallel rag screening units. Primary clarification, which is an economical BOD removal process, should have at least 4 units. Three or four aeration basins provide adequate flexibility if the startup load to the process is 50% or less of capacity. Installing four or more secondary clarifiers will prevent suspended solids overflow if one unit is out of service. The return sludge rate should be at least 100%. Optimum chlorination unit performance is attained with short feed lines and frequent removal of sludge from the chlorination basin. The effect of side streams entering the main process can be controlled by aerobic stabilization before return or by sludge thickening before digestion. Piping, storage space, and inlets should be provided for chemical addition even though it may not be part of the original process. Piping should be as short as possible, above ground, and include bypass lines and drain systems. Sampling lines should be provided as well as adequate monitoring instrumentation. In sludge management, liquid and solid sludges should be kept separate.
W86-03734

GOOD PROCESS CONTROL: PLANNING AND IMPLEMENTATION,
Polysar Ltd., Sarnia (Ontario).
R. Fioroni, and W. D. Frais.
In: Procedures and Practices in Activated Sludge Process Control, Butterworth, Boston. 1983. p 153-171, 4 fig, 1 tab.

Descriptors: *Wastewater treatment, *Activated sludge process, *Design criteria, *Operations, *Training, Biological wastewater treatment, Biox plant, Measuring instruments, Polysar, Ltd.

When the Polysar activated sludge plant at Sarnia, Ontario, was modified, three problems were considered: proper design, instrumentation, and training of personnel. Although the importance of process flexibility and controllability was recognized, the process operator was considered the key factor in a successful operation. The plant was designed to handle more than 200% of the average daily hydraulic flow and organic loading. Parallel and series configurations were designed for maximum flexibility. Instrumentation was designed to provide current information rapidly as well as historical data. Training was divided into pre-startup, and post-startup sections. Some personnel were onsite as much as 2 years before startup. The training courses are described in detail.
W86-03735

STARTUP CRITIQUE OF SARTELL 3,
Saint Regis Paper Co., Sartell, MN.
D. L. Keller.
In: Procedures and Practices in Activated Sludge Process Control, Butterworth, Boston. 1983. p 173-180, 2 fig, 1 tab.

Descriptors: *Wastewater treatment, *Activated sludge system, *Process control, *Pulp and paper industry, Biological wastewater treatment, Design criteria, St. Regis Paper Company, Sartell plant, Training, Dewatering, Clarifiers.

Practical suggestions are offered in a description of the startup of the fully automated waste treatment plant at the St. Regis Paper Company mill at Sartell, Minnesota. A successful startup begins with proper design and construction. Visits to similar plants during design can provide information which may be incorporated into the final design. Equipment should be on the market long enough for performance data to be available. Problems encountered in the plant startup included bent shafts on the pumping turbines, tripping of the clarifier drive (solved by increasing the clearance between floor and rake to 3 inches), and roll failures and belt mistracking in the sludge dewatering system.
W86-03736

SEPARATION OF BOUNDARY LAYER AND FLOW TURBULENCE OF CENTER-FEED CIRCULAR SEDIMENTATION BASINS,
Maryland-National Capital Park and Planning Commission, Upper Marlboro.
T-L. Yin.
In: Proceedings of Stormwater and Water Quality Management Modeling Users Group Meeting, March 25-26, 1982, Washington, DC. EPA-600/9-82-015, August 1982. p 152-161, 8 ref.

Descriptors: *Boundary layers, *Sedimentation basins, *Turbulent flow, Center-feed basins, Sedimentation, Basins, Circular basins.

This research analyzes boundary layer flow separation in center-feed circular basins by adopting some classical treatments of the problem. Analysis yielded the following conclusions: (1) In center-feed circular settling basins, the boundary layer flow separation does occur and also the subsequent reverse flow and vertical eddies at bottom of the settling basins, due to the continuous increase of pressure. Location of flow separation is analytically obtained. (2) The flow separation, reversed flow and eddies which cause turbulence of flow at basin bottom are believed to be the fundamental reason for less settling efficiency of center-feed settling basins compared with rectangular ones. (3) For practical purposes, it needs further study to quantify the impact of boundary layer flow separation on the turbulence of bottom flow and on the settling efficiency. (4) The reduction of settling efficiency due to boundary layer flow separation in center-feed circular basins may be considered not as important as some other factors in practical wastewater treatment operations and design. However, the analysis of the insight of the phenomenon and the location of the separation point of bottom flow might lead to improvement of design in circular settling basins or other related hydraulic structures.
W86-03830

PUBLICATIONS OF THE WATER RESEARCH INSTITUTE, 58.
National Board of Waters, Helsinki (Finland). Water Research Inst.
1985. 82 p.

Descriptors: *Filtration, *Wastewater treatment, *Domestic wastes, *Chemical precipitation, *Nutrient removal, Phosphorus removal, Nitrogen removal, Denitrification, Aeration, Pilot plants, Flocculation, Separation techniques, Organic compounds, Nitrification.

The series 'Publications of the Water Research Institute' contains scientific papers and processed data from the research fields of the Water Research Institute, National Board of Waters, Finland. The series is a sequel to the publications 'Communications of the Hydrological Office' and 'Soil and Hydrotechnical Investigations.' This publication contains papers on the topics of rapid filtration as a supplementary treatment of domestic sewage, combined nitrogen and phosphorus removal from wastewaters, and post-precipitation in wastewater treatment. In the first report, the applications of rapid filtration to sewage treatment in Central and Northern Europe are briefly examined. The second report examines efforts to find a reliable and simple method for the simultaneous removal of organic compounds, phosphorus and nitrogen from domestic sewage through activated sludge pilot-plant experiments on nitrification, post and predenitrification and intermittent aeration with and without ferrous sulfate addition. In the third report, the effects of chemical unit flocculation time and intensity on removal efficiency in post-precipitation plant (precipitant aluminum sulfate) were studied. (Geiger-PTT)
W86-03842

RAPID FILTRATION AS A SUPPLEMENTARY TREATMENT OF DOMESTIC SEWAGE,
A. Latvala.
IN: Publications of the Water Research Institute, 58, 1985. p 3-27, 21 fig, 8 tab, 30 ref, 1 append.

Descriptors: *Filtration, *Sand filters, *Domestic wastes, *Chemical precipitation, *Filter rates, *Wastewater treatment, Suspended solids, Biological oxygen demand, Phosphorus, Filters, Performance evaluations, Filtered wastewater, Sulfates, Separation techniques.

This study briefly examines rapid filtration applications of sewage treatment in Central and Northern Europe. Tests were made of the ability of low upflow filters to supplement simultaneous precipitation with ferrosulfate at two low-load plants. No chemicals were used in the filtration, and contact material was sand of finest grain size. Fluidizing water backwashing of the filter was supplemented with air. The ferrosulfate dose of simultaneous precipitation and filter rate were varied in the tests. Results for suspended solids, biological oxygen demand and total phosphorus were examined in detail. At one of the plants a total phosphorus level below 0.2 milligrams/liter was obtained using 100 g/cu m of ferrosulfate to simultaneous precipitation. The best results were obtained at low filter rates. Biological oxygen demand and suspended solids reductions in rapid filtration were generally 40-100%. A two-layer or upflow filter is preferred over a single-layer one for better filter efficiency and multiple storage capacity. (Geiger-PTT)
W86-03843

COMBINED NITROGEN AND PHOSPHORUS REMOVAL FROM WASTEWATERS,
M. Valve.
IN: Publications of the Water Research Institute, 58, 1985. p 28-54, 14 fig, 18 tab, 224 ref, 7 append.

Descriptors: *Activated sludge process, *Nitrification, *Denitrification, *Nutrient removal, *Wastewater treatment, Suspended solids, Biological oxygen demand, Phosphorus removal, Chemical oxygen demand, Phosphorus, Nitrogen removal, Activated suldge, Pilot plants, Aeration, Separation techniques, Sulfates, Organic compounds.

Activated sludge pilot-plant experiments on nitrification, post and pre-dentrification and intermittent aeration with and without ferrous sulfate addition were conducted to find a reliable and simple method for the simultaneous removal of organic compounds, phosphorus, and nitrogen from domestic sewage. Results showed that nitrification was inhibited at dosages of Fe(II) exceeding 30 g/cu m. Ferrous sulfate also had an inhibitory effect on the denitrification process. The post-denitrification process gave improper results. In the re-denitrification process, the nitrification rate was >80%, total nitrogen reduction 70%, and effluent phosphorous <1.5 milligram/liter. Similar results were observed for the intermittent aeration process. The SVI value, suspended solids, biological oxygen demand, and chemical oxygen demand were basically the same for both pilot plant units. (Geiger-PTT)
W86-03844

POST-PRECIPITATION IN WASTEWATER TREATMENT,
S. Valimaa, and M. Pietarila.
IN: Publications of the Water Research Institute, 58, 1985. p 55-82, 28 fig, 16 tab, 20 ref.

Descriptors: *Activated sludge process, *Sulfates, *Precipitation, *Flocculation, Biological wastewater treatment, Phosphorus, Nitrification, Phosphorus removal, Chemical oxygen demand, Activated sludge, Wastewater treatment, Separation techniques, Hydrogen ion concentration, Alkalinity, Cost analysis, Chemical treatment.

The effects of chemical unit flocculation time and intensity on removal efficiency in post-precipitation plant (precipitant aluminum sulfate) were studied. Also, the effect of the flow rate, precipitation dosage and nitrification were measured. A test was performed to operate the post-precipitation plant biological unit as a simultaneous-precipitation one (ferrosulfate), and results were collected from post-precipitation plants operating in Finland. The effect of flocculation factors on removal results in the parameter regulation range studied turned out to be small. Good results were achieved with first stirrer rotation speed 20-28 revolutions/min (G value 15-21/sec) and total residence time 10-30 min. Due to nitrification in biological unit and the precipitant, pH of wastewater occasionally altogether stopped. Simultaneous precipitation enabled a reduction in post-precipitation plant precitant costs. (Author)
W86-03845

THEORETICAL CONSIDERATIONS OF GRAVITY DEWATERING OF DREDGED MATERIAL THROUGH THE BOTTOM OF A CONTAINMENT AREA,
Japan Bottom Sediment Management Association, Tokyo.
T. Yoshida.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/Japan Experts Meeting. March 1985. p 41-62, 12 fig.

Descriptors: *Dredging, *Dewatering, Sludge drying, Soil mechanics, Soil water, Settling ponds.

The theoretical considerations of a pilot study utilizing short-term dewatering basins for dredged material, performed adjacent to a dredging site, are presented. The study, based on the principle of dewatering dredged material by gravity drainage, was conducted at Lake Suwa, Japan. It was concluded that in the management of dredged material the most important matter is to dewater the material as quickly as possible. Dewatering dredged material by gravity drainage is very effective in lowering the water content within a short time period. The drainage behavior of dredged material from the soil mechanics point of view is discussed. (Halterman-PTT)
W86-03870

RAPID DEWATERING TEST OF DREDGED MATERIAL IN SITU,
Japan Bottom Sediment Management Association, Tokyo.
M. Nakamura.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/Japan Experts Meeting. March 1985. p 63-73, 15 fig, 4 tab.

Descriptors: *Dredging, *Dewatering, Sludge drying, Soil mechanics, Soil water, Settline ponds.

The most popular method of reducing the volume of dredged material is natural evaporative dewatering. This method necessitates a long desiccation period of about 10 months and a large space. Conditions like these are difficult to overcome in the solution of water pollution problems, especially in lake restoration. To implement pollution control projects it is necessary to dewater dredged material as rapidly as possible and to overcome the unfavorable conditions mentioned above. A rapid dewatering test, conducted in Lake Suwa, Japan, is discussed. The efficiency of sun-dried and bottom drainage ponds was compared. The bottom drainage ponds produced superior results, and the concept that water in dredged material should be drawn out by gravity was verified by the test. (Halterman-PTT)
W86-03871

MECHANICAL DEWATERING OF DREDGED SLURRIES,
Rexnord, Inc., Milwaukee, WI.
P. R. Erickson, and J. Hurst.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/Japan Experts Meeting. March 1985. p 74-89, 12 fig, 1 tab, 9 ref.

Descriptors: *Dredging, *Dewatering, *Sludge drying, Spoil banks, Model studies, Pollution.

A 2.5-m-wide heavy duty belt press can dewater high density sludge at a rate of 20 to 30 tons/hr (dry basis). The unit is the largest factory preassembled module, and thus is transportable from site to site. It can be mounted on a concrete slab, truck-mounted, or mounted on a barge to eliminate dredge-to-shore pumping and piping problems. Energy required for dewatering is equal or less than current energy levels expedient when pumping from dredge to shore. It is anticipated that an 83% volume reduction would occur when converting a 15% solids dredged slurry to a 70% solids cake. Near term, belt press dewatering may especially fit into dredging operations where confinement is necessary or where chemical contamination is present in the dredgings and total solids capture is necessary. Final cake may be placed

directly into berm or dike construction, or, where chemical contaminants build up significantly, chemical fixation is feasible. (Author)
W86-03872

PROCEEDINGS OF THE CONFERENCE ON COMBINED MUNICIPAL/INDUSTRIAL WASTEWATER TREATMENT,
Robert S. Kerr Environmental Research Lab., Ada, OK.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-142133, Price codes: A23 in paper copy, A01 in microfiche. University of Texas at Dallas, March 25-27, 1980. EPA-600/9-81-021, Robert S. Kerr Environmental Research Lab., Ada, OK, April 1981. Edited by Aharon Netzer. 550 p.

Descriptors: *Wastewater treatment, *Industrial wastewater, *Municipal wastewater, Pollutants, Toxicity, Organic compounds, Sludge, Heavy metals, Water treatment facilities, Land disposal.

Papers discussing a wide variety of topics related to combined municipal/industrial wastewater treatment are presented. Specific areas of focus include: combined biological treatment, treatment of hazardous industrial compounds, textile wastes, wastewater reuse, land application of sludge, activated carbon use, case histories, textile wastes, treatment of priority pollutants, and heavy metal removal. (Halterman-PTT)
W86-03883

INNOVATION IN WASTEWATER TREATMENT,
Texas Univ. at Dallas, Richardson. Graduate Program in Environmental Sciences.
J. G. Moore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-142158, Price codes: A02 in paper copy, A01 in microfiche. IN: Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment, March 25-27, 1980, Dallas, Texas. Robert S. Kerr Environmental Research Lab., Ada, OK, April 1981. p 7-15.

Descriptors: *Wastewater treatment, *Wastewater, Industrial wastewater, Municipal wastewater, Water treatment facilities, Wastewater purification, Sludge, Chemical sludge, Sludge disposal.

Difficulties encountered in attempting to advance technology in the area of wastewater treatment are discussed, with specific examples provided which focus on combined industrial and municipal wastewater treatment. The problems with the concept of industrial cost recovery, the pre-treatment requirement, the concept of pollutants being resources 'out of place', and the problems of the disposal of the final residual, are outlined. Various aspects of sludge disposal are discussed, with the Detroit, Michigan municipal treatment facility presented as a case study. The opportunities for innovative wastewater treatment are predicted to be in the areas of pre-treatment of industrial wastewater, and in the production processes. (Halterman-PTT)
W86-03884

INDUSTRIAL CATEGORICAL PRETREATMENT STANDARDS,
Environmental Protection Agency, Washington, DC.
R. M. Southworth.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-142166, Price codes: A02 in paper copy, A01 in microfiche. IN: Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment, March 25-27, 1980, Dallas, Texas. Robert S. Kerr Environmental Research Lab., Ada, OK, April 1981. p 16-23, 2 tab.

Descriptors: *Wastewater treatment, *Wastewater, Waste treatment, Industrial wastewater, Municipal wastewater, Wastewater purification, Legal aspects, Legislation, Pretreatment of water.

The categorical pretreatment standards currently being developed by the Effluent Guidelines Division of the Office of Water Regulations and Standards, are outlined. Included are discussions of the pretreatment requirements in the Clean Water Act of 1977, EPA's general pretreatment regulations, and the procedure used to establish categorical pretreatment standards. Significant problems (addressed by the Clean Water Act of 1977) caused by discharges to publicly owned treatment works (POTW) include interference with POTW operations (fires, corrosion, explosions, hazardous fumes, system upsets); incompatibility, such as interfering with sludge disposal; and the passage of discharges through POTW. Categorical pretreatment standards are based on the degree of treatment that can be obtained by different technologies, considering the economic impact of those technologies. The philosophy behind establishing uniform categorical pretreatment standards is that all industries in a category, or subcategory, should have to treat their wastewater to the same degree of treatment. (Halerman-PTT)
W86-03885

COMPATIBILITY ASSESSMENT OF MUNICIPAL/INDUSTRIAL WASTEWATERS FOR COMBINED BIOLOGICAL TREATMENT,
A. W. Busch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-142182, Price codes: A03 in paper copy, A01 in microfiche. IN: Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment, March 25-27, 1980, Dallas, Texas. Robert S. Kerr Environmental Research Lab., Ada, OK, April 1981. p 31-44, 9 fig, 3 ref.

Descriptors: *Wastewater treatment, *Wastewater, Industrial wastewater, Municipal wastewater, Water treatment facilities, Biological treatment, Sludge, Wastewater purification.

There are numerous chemical and hydraulic aspects of biological treatment of combined municipal and industrial wastewaters. Compatibility is effected by qualitative and quantitative characteristics of the wastes involved. Assessment should include reaction rates, phase distribution of organics, concentration effects, hydrographs and relative volumes, transport time effects and nature of sludges produced. When compatibility assessment is properly done during process design, combined treatment is frequently not the best alternative. Because of legislation and regulations developed since 1970, combined biological treatment is less attractive now than ever. Separate treatment is increasingly the obvious method of choice where a choice can be made. (Author)
W86-03887

BIOLOGICAL INHIBITION SCREENING OF INDUSTRIAL WASTEWATERS,
Metcalf and Eddy, Inc., Wakefield, MA.
R. L. Stover.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-142190, Price codes: A04 in paper copy, A01 in microfiche. IN: Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment, March 25-27, 1980, Dallas, Texas. Robert S. Kerr Environmental Research Lab., Ada, OK, April 1981. p 45-59, 3 fig, 4 tab, 9 ref.

Descriptors: *Wastewater treatment, *Industrial wastewater, Inhibition, Inhibitors, Biological inhibitors, Bioassay, Nitrification, Microbiological studies.

A simple and inexpensive microbiological inhibition screening test procedure is discussed. The test can be conducted by treatment plant personnel at municipal plants receiving industrial wastewater discharges to provide estimates of the threshold inhibition levels to both the carbonaceous and nitrification reactions. This procedure consists of adding different dilutions of wastewater to a series of BOD bottles containing the appropriate seed source (carbonaceous or nitrifying) and monitoring the respective respiration rates. The factors affecting this inhibition screening procedure and important experimental design considerations are presented along with results from inhibition testing of various industrial wastewaters for both carbonaceous removal and nitrification. This test procedure can be employed to provide valuable screening information relative to biological treatment, as well as providing monitoring for problem assessment and changes in the daily operations of treatment facilities. (Halterman-PTT)
W86-03888

TREATMENT OF MUNICIPAL WASTEWATERS CONTAINING BIOLOGICALLY HAZARDOUS INDUSTRIAL COMPOUNDS BY CONVENTIONAL ACTIVATED SLUDGE AND EXTENDED AERATION,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
D. F. Kincannon, A. F Gaudy, and T. S. Manickam.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-142208, Price codes: A04 in paper copy, A01 in microfiche. IN: Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment, March 25-27, 1980, Dallas, Texas. Robert S. Kerr Environmental Research Lab., Ada, OK, April 1981. p 60-78, 8 fig, 2 tab, 4 ref. R-805242.

Descriptors: *Wastewater treatment, *Wastewater, *Industrial wastewater, Sludge, Activated sludge, Chemical sludge, Aeration.

Internal recycle bench scale reactors were used to study the effects of phenol, 2-chlorophenol, methylene chloride, and 4-chloro,3-methyl phenol on activated sludge and extended aeration processes treating a municipal wastewater. The activated sludge process was operated at a mean cell residence time of five days. The only solids wasted in the extended aeration units were those used for analyses and whatever solids were in the effluent from the final clarifier. The results of this study showed that the effluents of the extended aeration pilot plants were lower in soluble COD and particularly in suspended solids concentration than effluents from the 5-day systems. Increased suspended solids due to the presence of priority pollutants led to operational problems in maintaining a steady mean cell residence time except in the case of 4-chloro,3-methyl phenol. Presence of 4-chloro,3-methyl phenol did not upset the steady mean cell residence time. There was no evidence for massive pass through of any of the compounds for which specific analytical determination was made even at the high dosage level of 50 mg/l. (Author)
W86-03889

TREATMENT OF COMBINED INDUSTRIAL AND DOMESTIC WASTEWATER FOR REUSE IN SOUTH AFRICA,
National Inst. for Water Research, Pretoria (South Africa).
J. Van Leeuwen, L. R. J. Van Vuuren, J. F. J. Van Rensburg, and A. J. R. Du Plessis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-142216, Price codes: A05 in paper copy, A01 in microfiche. IN: Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment, March 25-27, 1980, Dallas, Texas. Robert S. Kerr Environmental Research Lab., Ada, OK, April 1981. p 79-92, 6 fig, 24 ref.

Descriptors: *Water reuse, *Wastewater renovation, Wastewater facilities, Pulp and paper industry, Bleach plants, Sludge, Activated sludge, Biofiltration, Biological wastewater treatment, Wastewater treatment.

The experience gained on various South African water reclamation plants is described. The types of water reuse discussed include: production of water for bleached pulp processing from domestic-industrial wastewater treated in a biofilter plant; production of water for fine paper production from domestic-industrial wastewater from an activated sludge plant; potable water production from biofilter and activated sludge effluents; high-quality water production from biofilter effluent of mainly industrial origin using an integrated physical-chem-

ical-biological process; and, potable water production from settled wastewater of mainly domestic origin using an integrated physical-chemical-biological process. The advantages of partial dependence of consumers on reclaimed water are discussed. A primary advantage is that disruption in supply from one of the sources will be less damaging than disruption of a single supply. (Halterman-PTT)
W86-03890

USE OF GRANULAR ACTIVATED CARBON TO TREAT MUNICIPAL WASTEWATER RECEIVING INDUSTRIAL FLOW,
ICI Americas, Inc., Wilmington, DE.
P. B. DeJohn, J. P. Black, and R. W. Edwards.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-142224, Price codes: A06 in paper copy, A01 in microfiche. IN: Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment, March 25-27, 1980, Dallas, Texas. Robert S. Kerr Environmental Research Lab., Ada, OK, April 1981. p 93-112, 3 fig, 7 tab, 20 ref.

Descriptors: *Wastewater treatment, *Water reuse, Sludge, Activated sludge, Municipal wastewater, Sanitary wastewater, Wastewater analysis, Wastewater composition, Wastewater renovation.

The necessity of removing a high degree of such pollutants as BOD, COD, and color from wastewater if it is to be reused, is discussed. Recommendations include: use of isotherms to determine if carbon can reduce impurities to the desired level; determination of relative size of pollutant molecules in a given waste by running comparative isotherms between lignite and bituminous coal carbons; design of granular carbon systems should be based on column studies, not isotherms; predominantly large molecules can best be removed by lignite carbons; small molecules can best be removed by unused bituminous coal, however once the carbon is regenerated the small pore range is lost; lignite carbon properties do not change as much as bituminous coal carbon properties upon regeneration. (Halterman-PTT)
W86-03891

FULL SCALE EXPERIENCE WITH ACTIVATED CARBON TREATMENT OF JOINT MUNICIPAL - INDUSTRIAL WASTEWATER,
Fitchburg Wastewater Treatment Facilities, MA.
J. L. Taylor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-142232, Price codes: A06 in paper copy, A01 in microfiche. IN: Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment, March 25-27, 1980, Dallas, Texas. Robert S. Kerr Environmental Research Lab., Ada, OK, April 1981. p 113-121, 2 fig, 7 ref.

Descriptors: *Wastewater treatment, *Activated carbon, Adsorbents, Sludge, Municipal wastewater, Sanitary wastewater, Industrial wastewater, Activated sludge, Pulp and paper industry, Wastewater facilities.

A case study is presented in which numerous mechanical and process difficulties have occurred in an advanced wastewater treatment facility. The facility used carbon for removing wastes because of extreme fluctuations in wastewater characteristics discharged by local industries, which made the maintenance of high quality effluent from a biological system extremely difficult. Also, the color removal capabilities of activated sludge was not known. Over time, various breakdowns occurred, involving the primary sludge pumping system, excess H_2S generation within the carbon columns, surface wash shower system failure, failure of the automatic flow control system, and corrosion of filter vessels. The need for major changes in the evaluation of processes and facility designs, before carbon adsorption can be considered for a major role in wastewater treatment facilities, is discussed. (Halterman-PTT)
W86-03892

TEXTILE WASTE TREATMENT AT A MUNICIPAL PACT FACILITY,
Zimpro, Inc., Rothschild, WI.
C. L. Berndt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-142240, Price codes: A07 in paper copy, A01 in microfiche. IN: Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment, March 25-27, 1980, Dallas, Texas. Robert S. Kerr Environmental Research Lab., Ada, OK, April 1981. p 122-140, 7 fig, 8 tab, 2 ref.

Descriptors: *Wastewater treatment, *Wastewater, *Aeration, *Activated carbon, Municipal wastewater, Industrial wastewater, Wastewater purification, Water treatment facilities, Sludge, Activated sludge.

The initial year of the operation of a powdered activated carbon treatment (PACT) facility is described. The municipal treatment facility performs well treating a highly colored wastewater. Both a low effluent 5-day BOD concentration (less than 5 mg/l), and efficient color removal have been maintained. The facility serves a residential population of approximately 30,000 people and an industrial fraction that consists of textile dye house operations, metal plating, and manufacturing industries. A flow chart of the treatment facility is presented, which includes coarse screen, grit removal chambers, clariflocculators, scrubbing channel (where generated carbon is added), coarse bubble diffusers, aeration tanks, carbon gravity thickeners, heat exchangers, filtration units and chlorinators. (Halterman-PTT)
W86-03893

REVIEW OF THE USE OF OZONE FOR IMPROVING COMBINED MUNICIPAL/INDUSTRIAL WASTEWATER TREATMENT,
Jacobs Engineering Group, Inc., Washington, DC.
R. G. Rice.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-142257, Price codes: A08 in paper copy, A01 in microfiche. IN: Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment, March 25-27, 1980, Dallas, Texas. Robert S. Kerr Environmental Research Lab., Ada, OK, April 1981. p 141-166, 3 fig, 10 tab, 25 ref.

Descriptors: *Wastewater treatment, *Wastewater, *Ozonation, Ozone, Municipal wastewater, Industrial wastewater, Wastewater purification, Water treatment facilities.

Ozone has been developed for the treatment of sewage since the early 1970's and primarily in the United States. Full scale plant operational data, and data from pilot plant testing upon which full scale plant designs have been developed are discussed. In plants providing tertiary treated wastewaters, including filtration of secondary effluents, when the wastewater does not contain significant levels of industrial wastes, the average absorbed ozone dosage required to achieve a disinfection level of 200 fecal coliform/100mL is 4 to 8 mg/L. However, when significant amounts of industrial wastes are present in the initial sewage, then absorbed ozone dosages can run as high as 10 to 15 mg/L. To attain the more rigid disinfection level of 2.2 total coliforms/100 mL using municipal wastewaters not containing industrial components requires 15 to 20 mg/L absorbed ozone dosage with filtered nitrified secondary effluent and 35 to 40 mg/L of filtered secondary effluent. Other uses of ozone in treating combined municipal/industrial wastewaters include oxidation of organic materials prior to passage through granular activated carbon. This technique appears to provide significant savings in costs associated with operation of granular activated carbon adsorbers. (Author)
W86-03894

USE OF SOLAR ENERGY FOR COMBINED MUNICIPAL-INDUSTRIAL WASTEWATER TREATMENT,
Utah Water Research Lab., Logan.
A. J. Acher.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-142265, Price codes: A08 in paper copy, A01 in microfiche. IN: Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment, March 25-27, 1980, Dallas, Texas. Robert S. Kerr Environmental Research Lab., Ada, OK, April 1981. p 167-179, 9 fig, 5 tab, 17 ref.

Descriptors: *Wastewater treatment, *Wastewater, *Solar radiation, Municipal wastewater, Industrial wastewater, Wastewater purification, Water treatment facilities, Radiation.

Three years of ongoing research on a new method for using solar energy for municipal and industrial wastewater treatment is discussed. Aerated municipal or industrial wastewaters containing dye-sensitizers were exposed to solar irradiation for various periods of time. The influence of the solar energy, absorbed by these sensitizers in the visible range, on the organic matter and anionic surfactants in secondary effluents was checked by determining the COD and MBAS values of treated wastewater. The disinfection potential of this method was followed by bacteriological analyses of running water or secondary effluents, previously contaminated or enriched, respectively, with laboratory cultures of E. coli, bacteriophages and polio virus. The influence of this photooxidative method was also studied on eutrophic algae present in the Lake of Galilee. It was found that the conditions under which disinfection proceeds also support algicidal processes, causing lethal damage to algal cultures. (Author)
W86-03895

LAND TREATMENT OF COMBINED MUNICIPAL/INDUSTRIAL WASTEWATERS,
Metcalf and Eddy, Inc., San Bernardino, CA.
C. E. Pound, and R. W. Crites.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-142273, Price codes: A09 in paper copy, A01 in microfiche. IN: Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment, March 25-27, 1980, Dallas, Texas. Robert S. Kerr Environmental Research Lab., Ada, OK, April 1981. p 180-187, 5 tab.

Descriptors: *Wastewater, *Wastewater treatment, *Land disposal, Waste disposal, Municipal wastewater, Industrial wastewater, Wastewater purification, Water treatment facilities.

The most direct measure of benefits from land treatment of municipal/industrial wastewaters is a cost comparison. Two cost studies are presented which illustrate several ways that land treatment can be used to provide cost effective solutions to municipal/industrial wastewater management. Selection by one city of a separate but publicly owned land treatment system for industrial wastes resulted in reductions in cost from $1.10/1,000 gal to $0.35/1,000 gal for the industrial waste contributions. Selection by another city of a combined municipal/industrial land treatment resulted in reducing costs for one example industry from $1.70/1,000 to $1.12/1,000 gal as compared to an activated sludge system. In the first case, both industrial and municipal systems were eligible for federal grant funding because the parallel approach was most effective. The municipal wastewater was treated to 40 mg/l BOD and the industrial wastewater was applied raw except for screening. In the second case, a single land treatment system was constructed as the most cost effective because the industrial waste flow was small compared to the total combined flow. (Author)
W86-03896

UTILIZATION OF SEWAGE SLUDGES ON CROPLAND,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
For primary bibliographic entry see Field 5E.
W86-03897

CITY OF CHATTANOOGA INDUSTRIAL-MUNICIPAL PRETREATMENT PROGRAM,

Chattanooga Interceptor Sewer System, TN. Moccasin Bend Treatment Plant.
E. G. Wright, G. E. Kurz, and D. A. Summers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-142315, Price codes: A11 in paper copy, A01 in microfiche.
IN: Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment, March 25-27, 1980, Dallas, Texas. Robert S. Kerr Environmental Research Lab., Ada, OK, April 1981. p 230-258, 6 fig, 11 tab, 7 ref.

Descriptors: *Wastewater treatment, *Wastewater, *Pretreatment of water, Municipal wastewater, Industrial wastewater, Wastewater purification, Regulations, Legal aspects.

Faced with stringent 201 grant requirements to accomplish industrial waste control for protection of its 50 million dollar wastewater plant expansion, the City of Chattanooga has developed an innovative and comprehensive industrial pretreatment program to satisfy the conditions in its grant agreement. The goal of the strict compliance schedule in the grant agreement was to achieve control of industrial wastes by 1983 so that the plant expansion scheduled for completion then will be able to meet its NPDES permit conditions. The pretreatment program that evolved from the grant conditions is unique since it was developed simultaneously with the promulgation of EPA's General Pretreatment Regulations, and has been tailored to meet the requirements of EPA's National Pretreatment Strategy. The program developed by Chattanooga is additionally incorporating the National Categorical Standards now being issued by EPA and is one of the few cities to have sufficient data on 'Consistent Removal' of toxic pollutants to apply to EPA for Local Removal Credits. The mass balance technique used by the City for developing local standards (as required by EPA regulations) has been adopted by the State of Tennessee and was recommended to the 41 cities in the State required to develop local programs. (Author)
W86-03899

INVESTIGATION ON THE SUITABILITY OF VARIOUS PESTICIDE MANUFACTURING WASTEWATER FOR DISCHARGE TO MUNICIPAL WASTE TREATMENT FACILITIES,
TRW Environmental Engineering Div., Research Triangle Park, NC.
E. C. Monning, L. W. Little, and R. Zweidinger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-142323, Price codes: A12 in paper copy, A01 in microfiche.
IN: Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment, March 25-27, 1980, Dallas, Texas. Robert S. Kerr Environmental Research Lab., Ada, OK, April 1981. p 259-271, 4 fig, 3 tab, 9 ref. 68-02-2612.

Descriptors: *Wastewater treatment, *Wastewater, *Pesticides, *Municipal wastewater, Wastewater purification, Atrazine, Carbaryl, Dazomet, Dinoseb, Glyphosate, Maneb, Mancozeb, Oryzalin.

The biological treatment of wastewaters from the production of atrazine, carbaryl, dazomet, dinoseb, glyphosate, maneb, mancozeb, and oryzalin is discussed. Data are presented indicating that the mechanism of removal during biological treatment of volatile organics such as toluene probably involves significant volatilization. Data are presented on the use of activated carbon as a pretreatment to biological treatment. A final example is noted regarding the difference between ozonating a pesticide in a pure solution and a pesticide in a mixed wastewater. (Author)
W86-03900

5E. Ultimate Disposal Of Wastes

TRANSPORT OF CONTAMINANTS FROM ENERGY PROCESS WASTE LEACHATES THROUGH SUBSURFACE SOILS AND SOIL COMPONENTS LABORATORY EXPERIMENTS,
Los Alamos National Lab., NM.
For primary bibliographic entry see Field 5B.
W86-03500

EFFECT OF SOIL ON THE MUTAGENIC PROPERTIES OF WASTE WATER,
Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
For primary bibliographic entry see Field 5C.
W86-03502

INSTRUMENTATION AND METHODS EVALUATIONS FOR SHALLOW LAND BURIAL OF WASTE MATERIALS: WATER EROSION,
Energy Resource Management, Tucson, AZ.
D. D. Hostetler, E. M. Murphy, and S. W. Childs.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-017582, Price codes: A05 in paper copy, A01 in microfiche.
RHO-C-56, August 1981. 80 P, 2 fig, 5 tab, 94 ref. DE-AC06-77RL01030.

Descriptors: *Waste disposal, *Hazardous materials, *Land disposal, *Erosion control, *Soil erosion, Erosion, Fate of pollutants, Models, Erosion rates, Erosion analysis, Sediment erosion, Monitoring, Waste management, Underground.

This report summarizes current literature regarding water erosion predictions and control and provides a basis for guiding the development of future erosion monitoring programs at the United States Department of Energy (DOE) hazardous waste disposal sites. The report includes a survey of existing erosion models and their parameters, a survey of current methods of instrumentation, an evaluation of important erosion considerations relative to shallow-land waste disposal sites, and recommendations for future courses of action. Many complex natural mechanisms interact in the erosion process. These interactions involve factors such as site meteorology, plant ecology, geology, topography, and hydrology. The basic principles of erosion control are: minimize raindrop impact on the soil surface, minimize runoff quantity, minimize runoff velocity, and maximize the soil's resistance to erosion. Some of these erosion control practices may jeopardize waste containment. Typical erosion control practices may enhance waste transport by increasing subsurface moisture movement and biologic uptake of hazardous wastes. An understanding of local site hydrology is needed for evaluating water erosion and waste transport. Baseline environmental parameters should be measured to some degree at each site. A two part monitoring program recommended for DOE hazardous waste disposal sites consists of reconnaissance and tracking and site instrumentation. (Geiger-PTT)
W86-03510

SLUDGE AND THE LAND: THE ROLE OF SOIL AND WATER CONSERVATION DISTRICTS IN LAND APPLICATION OF SEWAGE SLUDGE.
National Association of Conservation Districts, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-156307, Price codes: A02 in paper copy, A01 in microfiche.
430/9-82-007, September 1982. Final Report. 17 p, 2 append.

Descriptors: *Sludge disposal, *Sludge utilization, Waste disposal, Land disposal, Land spreading, Land reclamation, Land disposal, Heavy metals, Toxins.

As a consequence of increased quantities of sewage sludge and the growing unacceptiblity of traditional disposal methods, there is an upsurge of interest in the land application of sludge. Examples of land application opportunities include: spreading sludge on cropland, pasture or grassland; using sludge to help reclaim surface mined land, mine spoils, and other drastically disturbed lands; applying sludge products to gardens, nurseries and golfcourses; and applying sludge to forestland, park land or highway median strips. This booklet is aimed at facilitating communication between rural and urban areas in assessing sewage sludge management options involving land application. Alternative beneficial uses for sludge, alternative roles for soil and water conservation districts in land application; the difference between good and bad sludge for land application, and factors involved in designing a sludge application program for agricultural lands are briefly described. Finally, case histories of involvement of agricultural agencies in land application are presented. (Halterman-PTT)
W86-03514

WATER AND WASTE MANAGEMENT IN THE CANADIAN MEAT AND POULTRY PROCESSING INDUSTRY,
Dearborn Environmental Consulting Services, Mississauga (Ontario).
Report No. EPS-WP-81-3, June 1981. Environmental Protection Service, Ottawa, Ontario. Water Pollution Control Directorate. 297 p, 44 fig, 58 tab, 4 app, 8 ref.

Descriptors: *Water management, *Waste management, *Meat processing industry, *Water use efficiency, Poultry, Water use, Waste load, Cost-benefit analysis, Water pollution control.

Subsequent to visits to Canadian and American meat and poultry processing plants to evaluate existing water and waste management practices, demonstration studies were conducted at two Canadian red meat processing facilities to document the feasibility of in-plant control fo water use and process effluent waste loadings. These studies confirmed that water use and waste load reductions could be accomplished at minimal cost. In the red meat processing plants, the major areas of water use reduction involved shroud washing processes, employee hendwashers, carcass washers and viscera table washing systems. In the poultry processing plants, major reductions were accomplished in the water use associated with coop washing, feather transport, gooseneck handwashers and rotary screen backwashing. Considerable reductions in process effluent waste loadings were demonstrated at both red meat packing plants, primarily by improving the blood recovery systems. The process effluent BOD5 was reduced from 48% to 56% in these instances. There was no significant decrease in the waste loads at either of the two poultry processing plants. All process modifications were reviewed by Agriculture Canada and plant inspection staff prior to installation and evaluated during the studies to ensure that no detrimental effect on product quality resulted. The maximum cost of any single modification installed as a result of the demonstration studies was $7,700 for a blood recovery system at one of the red meat packing plants. The average cost of all other modifications was approximately $500. Several changes were implemented at no cost. At all four plants, the costs of the modifications could be recovered in less than one year. The site-specific nature of water use patterns and facilities at a particular plant was determined to be an important factor in identifying the modifications that can be successfully implemented. A number of reuse/recycle schemes which require further study were also identified.
W86-03612

STATUS REPORT ON COMPLIANCE WITH THE CHLOR-ALKALI MERCURY LIQUID EFFLUENT REGULATIONS 1980-81,
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
Report No. EPS 3-WP-83-2, February 1983. 16 p, 3 fig, 1 tab, 3 append.

Descriptors: *Mercury, *Effluents, *Regulations, Wastes, Wastewater treatment, Chlor-alkali plants.

This report reviews the results of the meausres taken by industry and government agencies to curtail mercury losses in liquid effluents from chlor-alkali plants in Canada. Similar status reports were issued for the years 1975, 1976-1977 and 1978-1979. Mercury losses to liquid effluents are presently less than 110 kg/y, a reduction of over 99.8% since 1970. Daily monitoring by companies and periodic monitoring by both federal and provincial environmental agencies have confirmed this reduction. The drastic reduction in mercury purchases and consumtion since 1970 is the result of

the installation of efficient treatment systems, and increased recovery of mercury from waste gases and solids, as well as the closure or conversion of ten plants. Only minor reductions will likely occur in the future, as all companies are practicing best operating and treatment technology for mercury cell plants.
W86-03633

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR SLUDGE DISPOSAL FOR THE DES MOINES INTEGRATED COMMUNITY AREA,
TenEch Environmental Engineers, Inc., Louisville, KY.
G. T. Boblitt, J. W. Braswell, S. H. Fralish, G. M. Gibbons, and L. W. Grauvengel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-120253, Price codes: A09 in paper copy, A01 in microfiche. EPA 907/9-82-002, July 1982. Environmental Protection Agency, Kansas City, MO. 190 p, 13 fig, 35 tab, 62 ref, 3 append.

Descriptors: *Sludge disposal, *Wastewater treatment, *Digestion, *Land disposal, *Environmental impact statement, *Land use, *Composting, *Fate of pollutants, Sludge digestion, Dewatering, Des Moines, Iowa, Environmental effects, Water quality, Wildlife, Odors, Vegetation, Aquatic life, Social impact, Economic impact, Employment, Fertilizers, Aesthetics, Public health, Water supply, Alternative planning, Flotation, Sludge thickening, Thickening, Anaerobic digestion, Land reclamation, Soil management, Heavy metals, Metals, Landfills, Pathogens, Wetlands.

Eleven alternatives for sewage sludge disposal were evaluated for the Des Moines Integrated Community Area. Problems with the present sludge treatment operation and the proposed construction of a regional wastewater treatment plant necessitated the study. The proposed action includes dissolved air flotation for dewatering, truck transportation, and ultimate disposal via land application at agronomic rates. Methane gas produced during the digestion will be used to heat digesters and generate electricity. Probable environmental impacts include the following: accumulation of heavy metals and organic material in the soil and adverse effects on water quality, air quality, noise aquatic and terrestrial life. Proper selection of sludge haul routes and proper management of the sludge application program can minimize these problems. Significant quantities of heavy metals may be removed by a pretreatment program. Sludge application would benefit plant growth and the energy-balance. Socioeconomic effects are minimal but beneficial, providing low-cost fertilizer and improvement in waste collection and treatment for the community. Transportation, aesthetics, and public health may be adversely affected by increased truck traffic, accelerated road deterioration, odor nuisance, and possible contact between the sludge and the public.
W86-03635

WASTEWATER TREATMENT SYSTEM FOR A LURGI COAL GASIFICATION PLANT,
ANG Coal Gasification Co., Detroit, MI.
For primary bibliographic entry see Field 5D.
W86-03639

POLLUTION CONTROL: THE HIDDEN PROFIT CENTRE,
Rupke and Associates Ltd., Bradford (Ontario).
For primary bibliographic entry see Field 5D.
W86-03671

ANTI-TURBIDITY OVERFLOW SYSTEM (ATOS) USED FOR REDUCING THE DISPERSION OF FINE SEDIMENTS FROM A DREDGE PLANE,
Minerals Management Service, Reston, VA.
M. J. Cruickshank.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/ Japan Experts Meeting. March 1985. p 106-113, 5 fig, 2 tab.

Descriptors: *Dredging, *Turbidity, *Sediment control, Suspended load, Suspended solids, Bottom sediments, Sand, Silt.

The 'Anti-Turbidity Overflow System for Hopper Dredger' (ATOS) developed in Japan is described and its use in the United States is discussed. By the removal of air trapped in the overflow slurry from a hopper dredge, and the placement of the overflow below the water line, reductions in visible surface plume effects were achieved by a factor of 40 in silty sands. The effects were not so noticeable in coarse sands. The U.S. Department of the Interior, Minerals Management Service (MMS) is responsible for managing the production of minerals from the Outer Continental Shelf. In an effort to further quantify the effects of installations of an ATOS on a dredge used for mining offshore, the MMS and the United States/Japan Cooperative Program in Natural Resources are preparing a test to take place in Shimonoseki Port in Northern Kyushu. The purpose of the test is to characterize the magnitude and behavior of turbidity plumes associated with a dredging operation with and without ATOS. Plume characteristics, including magnitudes in three dimensions--trajectory, density, and density gradients and suspended sediments--will be measured as a function of time. The test is planned for the spring of 1984. (Halterman-PTT)
W86-03874

NEW TECHNIQUES DEVELOPED IN JAPAN FOR OIL SPILL CLEANUP,
Japan Workvessel Association, Tokyo.
For primary bibliographic entry see Field 5B.
W86-03875

THEORETICAL CONSIDERATION OF POND AND SPILLWATER TREATMENT DESIGN,
Japan Bottom Sediment Management Association, Tokyo.
For primary bibliographic entry see Field 5G.
W86-03876

ALTERNATIVES TO OPEN WATER DISPOSAL OF CONTAMINATED DREDGED MATERIAL,
Army Engineer District, New York.
C. A. Coch, J. F. Tavolaro, R. F. Krauser, and P. Tischbein.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/ Japan Experts Meeting. March 1985. p 176-197, 6 fig, 4 tab, 32 ref.

Descriptors: *Dredging, *Hazardous materials, *Toxic wastes, Ocean dumping, Toxicity, Contamination, Pollutants, Economic aspects, Public health aspects, Legal aspects, Landfills.

Of the 6 to 7.5 million cubic meters of dredged material generated each year from the New York Harbor Area, 2 to 5% has been determined to be unacceptable for unrestricted ocean disposal. Three disposal options are being studied which could accommodate this material: use of dredged material as sanitary landfill cover, upland disposal, and containment areas and islands. In a dewatered state, dredged material could be used as a substitute for traditional cover material at sanitary landfills. Chemical and engineering tests were performed on representative dredged material from New York Harbor, and it was determined that all material is environmentally acceptable and may be economically feasible for this use. Potential upland disposal areas (barren areas) were evaluated using environmental and socioeconomic criteria to eliminate unacceptable sites. Containment area and island siting criteria were developed to eliminate highly biological productive areas in New York Harbor from consideration. Further efforts for all three disposal options are being directed at site availability, social acceptability, and detailed environmental and economic studies. All three options appear to be technically feasible. Sanitary landfill cover may prove to be a use of dredged material as a resource. However, the most problematic aspects of these disposal options involve their social acceptability rather than technical aspects. (Author)
W86-03879

BENEFICIAL USES OF DREDGED MATERIAL: AQUACULTURE IN DREDGED MATERIAL CONTAINMENT AREAS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
J. D. Lunz.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/ Japan Experts Meeting. March 1985. p 226-244, 7 fig, 2 tab, 13 ref.

Descriptors: *Dredging, *Aquaculture, Sediments, Pollutants, Economic aspects, Ponds, Sedimentation basins, Settling basins, Containment areas.

A Corp of Engineers two-day workshop on aquaculture in dredged material containment areas was conducted in 1982. The proceedings of the workshop are briefly summarized and include discussions about: site characteristics; site acquisition and permitting; contaminated dredged material; economics; pond design and construction; pond operation and management considering water quality, production, and disease control techniques; operational compatibility between dredged material disposal and aquaculture; and prospects for success. At a time when commercial aquaculturists are saying that the lack of available coastal sites has been the principal restraint on the application of commercially practical culture technologies, coastal lowland availability could be increased for culturists willing to operate in a containment area. The necessary, preliminary desk-top analyses have taken the idea as far as possible. Before the concept is likely to be tried by an American aquaculturist working together with coordinated Corps of Engineers dredged material containment operations, a successful, full-scale field demonstration will need to be conducted. Such a demonstration will probably require Federal subsidy. (Author)
W86-03882

UTILIZATION OF SEWAGE SLUDGES ON CROPLAND,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
L. E. Sommers, and D. W. Nelson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-142281, Price codes: A09 in paper copy, A01 in microfiche. IN: Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment, March 25-27, 1980, Dallas, Texas. Robert S. Kerr Environmental Research Lab., Ada, OK, April 1981. p 188-208, 8 tab, 55 ref. W-124.

Descriptors: *Wastewater, *Sludge, *Wastewater treatment, *Land disposal, Waste disposal, Municipal wastewater, Industrial wastewater, Wastewater purification, Water treatment facilities.

The application of sewage sludges on cropland is receiving increased emphasis because of environmental and economic constraints being placed on alternative disposal methods. Sewage sludges contain macronutrients (N,P, and K) and trace elements (e.g. Zn, Cu, Mn, and Mo) required for plant growth and thus, sewage sludges can be used as a low analysis fertilizer material. Numerous studies have indicated that comparable crop yields can be obtained by fertilizing soils with either sewage sludges or conventional inorganic fertilizer materials. However, sewage sludges also contain other constituents, primarily of industrial origin, which may limit their application rate on cropland. The sludge components of greatest concern include pathogens, slowly-degraded organics (e.g., PCB') and non-essential heavy metals (Ni, Cd, and Pb). Approaches being developed for land application of sewage sludges are based on maintaining the productivity of agricultural cropland and the quality of the environment. Developing a land application system involves the following considerations: (1) pathogens; (2) nitrate and heavy metal leaching into groundwaters; (3) effects on human health resulting from Cd accumulation in crops; (4) phytotoxicity due to increased soil levels of Cu, Zn, and Ni and; (5) contamination of crops with persistent organics such as PCB's. (Author)

W86-03897

5F. Water Treatment and Quality Alteration

WATER 2000, VOLUME V: WATER SUPPLY FACILITY OPTIMIZATION IN NORTHERN NEW CASTLE COUNTY.
New Castle County Water Resources Agency, DE.
Volume V, A Water Plan for New Castle County, DE. February 1983. 40 p, 8 fig, 11 tab, 20 ref.

Descriptors: *Water supply, *Potential water supply, *Water demand, *Water resources development, *Pumpage, Forecasting, Water policy, Water conveyance, Peak demand, Population dynamics, Effective capacity, Planning.

WATER 2000 is a multi-volume future water resources plan with the goal of achieving and maintaining a balance between water resources and water use while minimizing costs to the public and conflicts with other community goals. Volume V presents a view of existing public water systems in the county and analyzes them relative to anticipated future demands. The work is limited to the contiguous public water systems north of the Chesapeake and Delaware Canal. The area's existing water supply is drawn from surface water and ground water. Previous population projections forecasted a high growth rate based on increases from the 1940s through the 1960s; however, in the 1970-80 period there was only a 3% increase. Total water demand has increased in the last 30 years but the overall rate has been declining more recently. By taking current pumpage levels for residential, commercial, light industrial and industrial uses and adding usages based on the population growth, projected demands for these categories were developed through the year 2010. The average daily mgd in 1980 is 72.9 and increases to 81.2 mgd in 2010, which includes future water projects such as withdrawal, treatment, transmission and storage facilities. The collective capacity of the water users will exceed average demand by 40 mgd in 1990, 39 mgd in 1000 and 37 mgd in 2010. However, if the capacity of the existing facilities is utilized on a regional basis, it would not be necessary to construct any major new supply or treatment projects to meet anticipated demands over the next thirty years. (Atkins-Omniplan)
W86-03443

CHLORINE DIOXIDE CHEMISTRY: GENERATION AND RESIDUAL ANALYSIS,
Stanford Univ., CA. Dept. of Civil Engineering.
E. M. Aieta, and P. V. Roberts.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 429-452, 3 fig, 12 tab, 7 ref. R-805426.

Descriptors: *Water treatment, *Pollutant identification, *Wastewater treatment, *Chlorine dioxide, *Disinfection, Residual chlorine, Chlorine, Chlorite, Chloride, Chlorate.

A method for measuring the concentrations of chlorine dioxide and related species was based on amperometric and iodometric techniques. The procedure consists of the following steps: (1) measurement of chlorine dioxide by ultraviolet absorption spectrophotometry at 360 nm, (2) measurement of the sum of chlorine dioxide and chlorine by amperometric titration at pH 7, (3) measurement of the sum of chlorine dioxide, chlorine, and chlorite by iodometric titration at pH 7, (4) measurement of the sum of chlorine dioxide, chlorine, chlorite, and chlorate by step 3, after allowing prior reaction with concentrated HCL, and (5) measurement of chloride by an adaptation of the mercuric nitrate method. The molar yield of chlorine dioxide by acid activation was about 50% when sulfuric was used; 75-80% when hydrochloric acid was used. When chlorine dioxide was generated by the reaction of sodium chlorite with chlorine (4% excess), the yield of chlorine dioxide based on chlorite reactant was 93-98% based on chlorite feed. Use of excess chlorine appeared not to increase chlorine dioxide yield but to retard subsequent reactions that consume the chlorine dioxide product.
W86-03540

REDUCTION OF TRIHALOMETHANE PRODUCTION WITH OPTIMAL DISINFECTION THROUGH ALTERNATIVE DISINFECTION SYSTEMS,
Texas Univ. at San Antonio. Center for Applied Research and Technology.
R. F. Williams, B. E. Moore, K. E. Longley, and C. A. Sorber.
IN: Chemistry in Water Reuse: Volume I, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 477-500, 3 fig, 10 tab, 20 ref.

Descriptors: *Water treatment, *Disinfection, *Chlorine, *Chlorinated hydrocarbons, Trihalomethanes, Ammonia, Chloramine, Chlorine dioxide.

Rapid hydraulic mixing increased the speed of bacterial inactivation with chlorine, chlorine dioxide, and chlorine-ammonia. At a dose of 1.5 mg per liter, chlorine achieved total inactivation in 16 sec. For chlorine followed by ammonia, inactivation occurred within 15 min for a 1.5 mg per liter dose and within 1 min for a 5 mg per liter dose. A dose of 0.5 mg per liter chloramine required 60 min for inactivation. Lower disinfectant doses produced lower levels of trihalomethanes. The total trihalomethane concentrations (in micrograms per liter) observed with doses of 0.2-5.0 mg per liter disinfectant were (1) chlorine, 4.29-179.3; chlorine followed by ammonia, 2.47-10-10.24; and ammonia followed by chlorine, 0.13-4.31. The best choice for optimal disinfection and lowest trihalomethane formation was 1.5 mg per liter ammonia followed by 1.5 mg per liter chlorine. Total disinfection was achieved with 15 min contact and the trihalomethane level was reduced 275-fold compared with a 1.5 mg per liter chlorine dose.
W86-03542

INSOLUBLE POLYMERIC CONTACT DISINFECTANTS: AN ALTERNATIVE APPROACH TO WATER DISINFECTION,
State Univ. of New York at Binghamton.
G. E. Janauer, C. P. Gerba, W. C. Chiorse, M. Costello, and E-M. Heurich.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 501-522, 6 fig, 3 tab, 52 ref.

Descriptors: *Water treatment, *Disinfection, *Polymers, Quaternary ammonium compounds, Resins, Resin 12, Contact disinfection.

Insoluble polymeric contact disinfectants (IPCD) are an alternative to dissolved reactive disinfectants such as chlorine. Demand release disinfectants and surface-bonded microbials provide some of the advantages of IPCD. Resin 12 (a weakly crosslinked chloromethylated polystyrene functionalized with N,N-dimethyldodecylamine) and variations using different quaternary ammonium compounds show promise as disinfectants, particularly in small point-of-use systems. Practical problems remaining are the effect of temperature, counterions, and water hardness and rapid regeneration of the resin.
W86-03543

5G. Water Quality Control

ROLE OF ENVIRONMENTAL TRANSPORT AND FATE MODELS IN IMPLEMENTING THE TOXIC SUBSTANCES CONTROL ACT,
Environmental Protection Agency, Washington, DC. Office of Pesticides and Toxic Substances.
For primary bibliographic entry see Field 5B.
W86-03420

SIGNIFICANCE AND LIMITATIONS OF ENVIRONMENTAL COMPARTMENTALIZATION MODELS IN THE CONTROL OF NEW CHEMICALS BASED ON THE ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT MINIMUM PREMARKETING SET OF DATA,
Umweltbundesamt, Berlin (Germany, F.R.).
A. W. Klein, and F. Schmidt-Bleek.
IN: Modeling the Fate of Chemicals in the Aquatic Environment, Ann Arbor Science, Ann Arbor, MI. 1982. p 73-92, 7 fig, 3 tab, 15 ref, 1 append.

Descriptors: *Model studies, Pollutants, *Economic aspects, Aquatic environment, Fate of pollutants, Prediction, Path of pollutants, Legal aspects, Toxicity.

Because of the increasing concern over potential and actual hazards to man and his environment through the largely uncontrolled use of commercial chemicals, a number of key chemical-producing countries have recently passed, or are in the process of passing, chemical control legislation. Several concepts are emphasized in relation to the 'preventive' control nature of much of the new legislation. These concepts include the entry of potentially dangerous chemicals into the environment, exposure and effect of chemicals, steps toward environmental hazard assessment, significance of environmental exposure analysis within 'hazard ranking' process for chemicals, and, finally, environmental exposure models. (Halterman-PTT)
W86-03423

LEGAL VALIDATION OF ENVIRONMENTAL FATE MODELS,
ERM-Southeast, Inc., Brentwood, TN.
F. G. Ziegler.
IN: Modeling the Fate of Chemicals in the Aquatic Environment, Ann Arbor Science, Ann Arbor, MI. 1982. p 379-386.

Descriptors: *Model studies, *Fate of pollutants, Pollutants, Ecosystems, Mathematical models, Distribution, Toxicity, Kinetics.

Potential legal challenges that will occur as a result of the application of environmental fate models are discussed. Both technical and legal challenges associated with modeling are included. Model adequacy is divided into two categories: adequacy of initial model development; and adequacy of specific applications of the model. Adequacy with regard to a specific application of an environmental fate model dictates to the user a demonstration with a thorough and well designed field sampling investigation followed by proper interpretation of data, as well as calibration and validation. Realistic interpretation of the data and realistic discussions of adequacy regarding its intended purpose must occur within the modeling analysis. (Halterman-PTT)
W86-03434

POLYCHLORINATED BIPHENYLS (PCBS),
California State Water Resources Control Board, Sacramento. Toxic Substances Control Program.
R. P. Ghirelli, and F. H. Palmer.
Special Projects Report No 83-1sp, May 1983. (Reprinted January 1984) 174 p. 19 fig, 40 tab, 194 ref, 8 append.

Descriptors: *Polychlorinated biphenyls, *Monitoring, *Water quality control, *Water pollution sources, Toxicity, Mammals, Carcinogens, Biochemistry, Bass, Pesticides, Mussels, Regulations, Environmental protection, Environmental effects, Chlorinated hydrocarbons, Pollutants, Fish, Shellfish.

In February 1982 the California State Water Resources Control Board initiated an industrial chemicals program based on the premise that the production and use of chemicals should not occur at the expense of water quality protection. This report assesses the properties and uses of polychlorinated biphenyls (PCBs), their environmental fate and toxicology, and the impact of PCBs on human health and California's aquatic resources. The report proposes a water quality strategy for controlling PCBs and actions for consideration by affected state, local, and federal agencies. PCBs, known to be hazardous to humans and aquatic life, are found in air, water, sediment, and biota

throughout the world. Further dissemination into the environment of these long-lived compounds should be presented. Of the 1.4 billion pounds of PCB produced in the U.S. since 1929, over half are still in service. PCBs are chlorinated hydrocarbons that are chemically stable, and have low flammability, high boiling points, and low electrical conductivity. All commercial PCB formulas contain contaminants, such as polychlorinated dibenzofurans (PCDFs), more toxic to humans and aquatic life than PCBs. Airborne transport and deposition is the major pathway for the global distribution of PCBs and other persistent chlorinated hydrocarbons. With extremely low water solubility and high affinity for organic material, PCBs persist in sediments and biological material. Although PCBs are not acutely toxic to mammals except at high doses, their chronic effects are pronounced at relatively low doses. (Fazio-Omniplan)
W86-03446

RICE HERBICIDES: MOLINATE (ORDRAM) AND THIOBENCARB (BOLERO),
California State Water Resources Control Board, Sacramento. Toxic Substances Control Program.
J. W. Cornacchia, D. B. Cohen, and G. W. Bowes.
Special Projects Report No. 84-4sp, April 1984. 176 p. 32 fig, 27 tab, 143 ref, 14 append.

Descriptors: *Rice, *Herbicides, *Thiocarbamate pesticides, *Water quality, *Water quality control, Cultivation, Pesticides, Weed control, Aquatic weed control, Irrigation practices, Environmental effects, Monitoring, Risks, Toxicity, Fisheries, Drinking water, Fish, Anadromous fish, Mammals, Shrimp.

Increased findings of rice herbicides in Sacramento Valley drains and the Sacramento River and Delta raise two issues: What effects do the annual discharge of molinate and thiobencarb, the active ingredients of two rich herbicides (Ordram and Bolero), have on Valley water quality. If these effects are adverse, how can the discharge be controlled or eliminated. This report describes rice cultivation and weed control practices, gives an overview of molinate and thiobencarb environmental monitoring, assesses impacts on aquatic life and human health, and evaluates discharge control alternatives. The Valley supports over 90% of the rice grown in California. During 1977-82 the application of Ordram and Bolero more than tripled. Approximately 6-11% of the Ordram applied in 1981 and 1982 was discharged to the Sacramento River; Bolero discharges ranged between 3-5%. A comprehensive assessment of molinate and thiobencarb hazards of resident and anadromous fish is not possible because there are few chronic toxicity studies of these two chemicals and their mixtures. Warm water recreational fisheries in agricultural drains and sloughs have received the highest rich herbicide exposures. The highest concentrations of both herbicides (over 2,000 parts per billion) have been detected in the edible portions of fish during the rice herbicide use season. The key to minimizing nonpoint source discharge of rice pesticides is the integration of pest control and water management strategies at the rice field, the sub-basin, and the main drainage basins. (Fazio-Omniplan)
W86-03447

RELATIONSHIP BETWEEN STREAM RECREATIONAL USE AND STREAM CHARACTERISTICS WITH IMPLICATIONS FOR MANAGEMENT OF ILLINOIS STREAMS,
Illinois Dept. of Conservation, Springfield.
R. D. Westfall, and M. P. Armstrong.
IN: Proceedings of a Conference on Management Techniques for Water and Related Resources, April 1984. p. 105-112. 2 fig, 1 tab, 14 ref, 1 append. Illinois University at Urbana-Champaign, Water Resources Center, October 1984, Special Report 14.

Descriptors: *Stream profiles, *Streams, *Recreation, *Management planning, Basins, Public access, Surveys.

Basic information on the relationship between recreational use of the type of streams typical of Illinois and their physical characteristics is generally unavailable. The study was designed to develop a preliminary model of recreational use and stream chracteristics and to determine if a stream's lack of disturbance was related to its use. The study provides evidence that a simple explanatory model of river recreational use for Illinois can rely on two easily measurable stream characteristics--stream size and public access. Stream disturbance, as measured in this study, does not exhibit a strong negative correlation with recreational use, at least for streams in the Sangamon Basin. Certain stream characteristics such as natural areas, historic sites, and public recreation land, which might be expected to show high positive relationships with recreational use, do not significantly relate to use. The Sangamon River Basin in central Illinois, comprising 5,488 square miles (approximately one-tenth of the state) was selected for study because data on both recreational use and stream characteristics were available and the basin is generally representative of much of Illinois. The study relied on data contained in the Streams Information system, a computerized inventory of physical, chemical, biological, cultural, and recreational characteristics of Illinois rivers. The findings have relevance for recreational management of Illinois' rivers and streams. (Fazio-Omniplan)
W86-03451

PLANNING APPROACH FOR IMPROVED MANAGEMENT OF ILLINOIS STREAMS FOR RECREATION AND CONSERVATION,
Illinois Dept. of Conservation, Springfield. Comprehensive Planning Section.
E. L. Hoffman, R. D. Westfall, and G. Tichacek.
In: Proceedings of a Conference on Management Techniques for Water and Related Resources, April 1984. p 64-78, 2 fig, 1 tab, 14 ref, 1 append. Illinois University at Urbana-Champaign, Water Resources Center, October 1984, Special Report 14.

Descriptors: *Management planning, *Streams, *Recreation, *Conservation, Planning, Long-term planning, Basins, Natural streams, Macroinvertebrates, Riparian vegetation, Public access, Ecosystem.

Degradation of Illinois' streams, especially of their aquatic and riparian habitat, continues at an alarming rate. The Illinois Department of Conservation initiated a long-term Streams Preservation and Recreational Use Planning Project. This paper focuses on the planning element, suggesting a pragmatic approach to streams conservation. The approach includes eight considerations that should make the plan meet most decision maker's criteria of reasonableness. Given those considerations, a method for categorizing streams was developed based on biological integrity, naturalness, recreation value, and the presence of special features such as natural areas, historic sites, and public recreation land and access sites along the stream. This method systematically compares all ten square mile drainage or larger streams in the Sangamon River Basin and is potentially applicable statewide. The paper gives operational definitions of the four stream values and of nine more specific, measureable characteristics. In addition to its usefulness in characterizing individual streams, the categorization system also allows the Basin to be characterized as a whole. The distribution of 127 streams is reasonable even across five categories. For example, the percentage of riparian forest along streams steadily increases from 7% of bank miles (Category V streams with none of the four values) to 21.3% (Category I with all four values). (Fazio-Omniplan)
W86-03452

INDUCED CHANGE AND ITS IMPACT ON AQUATIC COMMUNITY QUALITY IN THE SANGAMON RIVER BASIN OF ILLINOIS,
Illinois Dept. of Conservation, Springfield.
G. Tichacek, R. D. Westfall, and E. L. Hoffman.
In: Proceedings of a Conference on Management Techniques for Water and Related Resources, April 1984. p 24-39, 4 fig, 1 tab, 10 ref, 1 append. Illinois University at Urbana-Champaign, Water Resources Center, October 1984, Special Report 14.

Descriptors: *Aquatic populations, *Aquatic life, *River basins, *Ecosystems, Water quality, Watershed, Fish, Land use, Streams, Stream profiles, Valleys, Sampling, Macroinvertebrates, Riparian waters, Land use, Recreation.

Alterations to streams and stream valleys are often substantial in states like Illinois which have been heavily developed. One of the features thought to be most sensitive is the health of stream aquatic communities. This report focuses on the Sangamon River Basin which covers approximately 10% of Illinois and is typical of the rural, intensively-farmed central portion of Illinois. The analysis relies on data contained in the Illinois Streams Information System which includes both linear stream characteristics and point data. Detailed sampling station data on fish, macroinvertebrates, stream physical characteristics, riparian characteristics and land use, recreational use, water quality, and other information were collected for the Basin in 1981 and 1982. The various multivariate and bivariate analyses did not detect the expected systematic relationships at a statistically significant level. Minor exceptions occurred; however, consistency among relationships involving the three measures of aquatic community quality was not generally evident. Some expected relationships occurred, but in most cases did not reach statistical significance. For example, the Index of Biotic Integrity was positively correlated with preferred substrate. Percent intolerant macroinvertebrates was positively correlated with bankside forest and negatively correlated with disturbance measures. (Fazio-Omniplan)
W86-03453

GROUNDWATER CONTAMINATION AND EMERGENCY RESPONSE GUIDE,
Little (Arthur D.), Inc., Cambridge, MA.
J. H. Guswa, W. J. Lyman, A. S. Donigian, T. Y. Lo, and E. W. Shanahan.
Noyes Publications, Park Ridge, NJ. 1984. Pollution Technology Review, No 111. 490 p.

Descriptors: *Groundwater pollution, *Groundwater management, *Monitoring, *Reviews, *Geohydrology, Groundwater, Waste disposal, Hazardous materials, Decision making, Planning, Water management.

This book provides an overview of groundwater hydrology; a technology review of equipment, methods, and field techniques; and a methodology for estimating groundwater contamination under emergency response conditions. Part I assesses methodology for investigating and evaluating unknown or suspected cases of contamination, developing decision parameters, and selecting a remedial response. Part II surveys groundwater fundamentals, state-of-the-art equipment, monitoring methods, and treatment and containment technologies. This data will supply input to developmental efforts leading to more efficient, durable, and cost-effective monitoring and remedial action technologies. Part III describes possible emergency response actions at toxic spill and hazardous waste disposal sites. It provides a rapid assessment methodology for performing such an evaluation within a 24-hr emergency response time frame. (Geiger-PTT)
W86-03457

MANAGEMENT OF BOTTOM SEDIMENTS CONTAINING TOXIC SUSTANCES: PROCEEDINGS OF THE 8TH U.S./JAPAN EXPERTS MEETING,
Army Engineer Inst. for Water Resources, Fort Belvoir, VA.
November 8-10, 1982, Tokyo, Japan. July 1984. Thomas R. Paten, editor. 475 p.

Descriptors: *Water quality control, *Fate of pollutants, *Dredging, *Sediments, Lake restoration, Suspended sediments, Turbidity, Accumulation, Bioaccumulation, Fish.

Papers and in-depth discussions on dredging and disposal of contaminated sediments were presented by Japanese and American experts at a November

8-10, 1982 meeting. Dredging without significant resuspension of sediments was a common topic. Several new developments in equipment were described: Clean Up, Refresher, Pneuma pump. Studies included large lakes, harbors, and rivers. Other topics included dissolved oxygen profiles as affected by oxygen-demanding bottom sediments, bioaccumulation of toxic materials in contaminated sediments by biota, restoration of eutrophic lakes, and ocean disposal of dredged materials and sludge. (Cassar-PTT)
W86-03461

DREDGING AND MANAGEMENT PROBLEMS IN LAKE SUWA,
K. Nikado, and M. Akabane.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 8th U.S./ Japan Experts Meeting, November 8-10, 1982, Tokyo, Japan. July 1984. p 251-261, 11 fig, 3 tab.

Descriptors: *Water quality control, *Dredging, *Lake restoration, Lake Suwa, Japan, Dewatering, Sediments, Lake sediments, Coagulation, Filtration, Eutrophic lakes.

Dredging began in Lake Suwa, Japan, in 1969 in an effort to reduce eutrophication conditions. Although the first stage removed 1.5 million cu m of sediment from the shallow areas, no significant improvement was noted in lake water quality. Beginning in 1981 dredging began in the deeper areas with a goal of 5.3 million cu m to be removed (sediment up to 50 cm depth) over 20 years. Since dredged material could not be left near the lake, it had to be dewatered for transport to other locations. Mechanical dehydration proved more feasible than in-pond sedimentation. The dewatering system consisted of addition of 45 ppm of inorganic flocculant (PAC), addition of 3-7 ppm of polymeric coagulant, and filter pressing. (Cassar-PTT)
W86-03462

REMOVAL OF BOTTOM SEDIMENTS IN OSAKA PORT BY THE PNEUMA PUMP DREDGE 'SHUNKAI',
Osaka Port and Harbour Bureau (Japan).
S. Kasajima.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 8th U.S./ Japan Experts Meeting, November 8-10, 1982, Tokyo, Japan. July 1984. p 16-39, 7 fig, 12 photos, 3 ref.

Descriptors: *Water quality control, *Dredging, *Sediments, Pneuma pump, Osaka, Japan, Water pollution prevention, Pumps, Odor control, Suspended sediments, Turbidity, Oily water, Harbors, Rivers.

The Pneuma pump system has been used successfully since 1974 to dredge polluted mud from the port of Osaka, Japan, and its tributaries. This dredging system can dredge a high solids concentration at any depth without fear of secondary pollution. It consists of a pump body, a distributor, and a compressor. The pump body consists of three cylindrical tanks used as one assembly. Each tank is fitted with an inlet port, an outlet port, and valves. Some results of dredging tests are as follows: a good dredging speed is 1-3 m/min; rubbish on the sea bed does not interfere; the shovel should be designed for the site; water transparency at the surface declines by 15-20 cm during dredging; and pan-floc application is not suitable for mud with very high solids concentrations. Design of the equipment and auxiliary equipment is discussed in detail. Measures for preventing secondary pollution include scrubbing of sulfur-smelling gases, placing a deodorant (95% bentonite, phyroligneous acid, and papain) on the filled barges, control of oily scum, and precipitation of suspended solids in surplus water. (Cassar-PTT)
W86-03463

CAPPING OF DREDGED MATERIAL DISPOSAL MANAGEMENT FOR NEW YORK HARBOR,
Army Engineer District, New York.
J. M. Mansky.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 8th U.S./ Japan Experts Meeting, November 8-10, 1982, Tokyo, Japan. July 1984. p 78-93, 4 fig, 1 tab, 21 ref.

Descriptors: *Water quality control, *Dredging, *Sediments, *Metals, Heavy metals, Polychlorinated biphenyls, DDT, Organic compounds, Borrow pits, Disposal, New York Bight, Ocean dumping.

Monitoring studies conducted on contaminated sediment deposits in the New York Bight indicated that bioaccumulation in indicator mussels was generally less at a site capped with sand than at uncovered dump sites. The highest mean values for heavy metals were found at an uncapped site. These were as follows: Hg, 0.242 ppm; Cd, 0.081 ppm; and Pb, 1.13 ppm. At the capped site Hg levels were 0.030 ppm; Cd, 0.041 ppm; and Pb, 1.04 ppm. No statistically significant data was obtained for polychlorinated biphenyls or DDT. Mean fuel oil bioaccumulation was greater in the capped area than in the uncapped areas. A field trial with uncontaminated sediments indicated that subaqeous borrow pits could be used as disposal pits for contaminated dredged sediments if capped with sand. (Cassar-PTT)
W86-03464

RESTORATION STUDY OF DREDGING IN LAKE KSAUMIGAURA,
F. Kodama, and T. Fukushima.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 8th U.S./ Japan Experts Meeting, November 8-10, 1982, Tokyo, Japan. July 1984. p 94-111, 16 fig, 2 tab.

Descriptors: *Water quality control, *Lake restoration, *Dredging, Lake Kasumigaura, Japan, Eutrophic lakes, Sediments, Lake sediments.

Dredging is underway in the eutrophic Lake Kasumigaura, Japan, as part of a lake restoration project. Located in a drainage basin with 720,000 population, the 220 sq km lake originally had 40-50 cm of sediment. From 1975 to 1981 a total of 300,000 cu m of sediment was removed. The dredging system consists of vacuum suction with pneumatic discharge. Dredged material is dewatered in ponds or by progressive trenching. (Cassar-PTT)
W86-03468

SPECIALIZED DREDGES DESIGNED FOR BOTTOM SEDIMENT DREDGING,
A. Kaneko, Y. Watari, and N. Aritomi.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 8th U.S./ Japan Experts Meeting, November 8-10, 1982, Tokyo, Japan. July 1984. p 450-476, 24 fig, 11 tab, 2 ref.

Descriptors: *Water quality control, *Dredging, *Sediments, *Turbidity, Bottom sediments, REFRESHER dredge.

The REFRESHER, specialized equipment for reducing sediment resuspension while dredging, is based on the conventional cutter suction dredge. It has a gather head which is a ribbon blade with a reducing spiral at the front. It is suitable for cutting soft mud to hard ground. A cover and shutter are structured to prevent turbidity from leaking into the surrounding water. Check valves prevent back flow of sediment water into discharge pipes in an emergency. A gas collector apparatus delivers gas produced to the suction pipe. Field test results are given to show the turbidity created by this equipment. (Cassar-PTT)
W86-03469

PERFORMANCE TESTS OF PNEUMA DREDGE PUMP,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
T. W. Richardson.
Meeting, November 8-10, 1982, Tokyo, Japan. July 1984. p 419-433, 16 fig, 1 tab.

Descriptors: *Water quality control, *Dredging, *Sediments, Sand, Pumps, Pneuma pump, Turbidity.

The air-operated Pneuma dredge pump, model 600/1000, was tested at four locations (river channel, lock approach, tidal inlet, and dock) in sand and fine-grained sediments and in water depths from 1.8 to 10.7 meters. The pump removed fine-grained sediment from the bottom at an in situ density but could not achieve the same results in sand. High density discharge could be sustained for only 15 min or less. The pump could only excavate sand in water depths greater than 2.5 m. The Pneuma pump had a lower power efficiency (never greater than 20% and often less than 10%) than a centrifugal dredge pump. Turbidity levels generated by the pump were not excessive. (Cassar-PTT)
W86-03470

BOTTOM SEDIMENT DREDGE 'CLEAN UP' - PRINCIPLE AND RESULTS -,
E. Sato.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 8th U.S./ Japan Experts Meeting, November 8-10, 1982, Tokyo, Japan. July 1984. p 403-418, 6 fig, 3 tab, 1 ref.

Descriptors: *Water quality control, *Dredging, *Turbidity, *Sediments, Suspended sediments, CLEAN UP, Pumps, Bottom sediments.

CLEAN UP, new dredging equipment designed to minimize secondary pollution during dredging contaminated sediments, was constructed and field tested (45 trials) in Japan. It is equipped with a movable wing in front to overlie the bottom sediments, a movable shutter to intercept the inflow of outer water, a mixing device, and sensors to check the dredging conditions. The equipment can also control the contact pressure against the sea bed and stay horizontal regardless of depth. A submerged centrifugal pump was chosen. A swing velocity of 3-4 m/min was best for minimizing turbidity generation. An adequate cutting depth was 0.4-0.5 m. Turbidity was sometimes 80-100 ppm during starting of the pump or changing of the swing direction. The concept of generation unit of turbidity was developed. This is the total dry weight of turbidity that occurs during dredging work per 1 cu m of materials dredged from the sea bed (tons/cu m). (Cassar-PTT)
W86-03471

OVERVIEW OF CORPS RESEARCH PROGRAM ON DREDGING CONTAMINATED SEDIMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
R. L. Montgomery, and G. L. Raymond.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 8th U.S./ Japan experts Meeting, November 8-10, 1982, Tokyo, Japan. July 1984. p 381-402, 17 fig, 2 tab, 7 ref.

Descriptors: *Water quality control, *Dredging, *Sediments, *Suspended sediments, Monitoring, Fate of pollutants.

The problems of dredging contaminated sediments with existing conventional equipment and techniques are discussed. Since dredging practices in the U.S. have evolved to be cost efficient, most conventional dredges are not specifically designed or intended for use in dredging highly contaminated sediments. This paper outlines active research at the Waterways Experiment Station on equipment and techniques for dredging contaminated sediments. The question of dredging in contaminated sediments is being addressed in three ways: the assembly and evaluation of available domestic and foreign information concerning sediment resuspension and contaminant release, the development of appropriate laboratory tests to predict contaminant release from resuspended sediments, and the use of field studies to monitor performance and compare dredges operating under various conditions. Preliminary studies involving the cutterhead, dustpan,

and clamshell dredges are discussed. The watertight clamshell appeared to reduce the amount of resuspended sediment in the upper water column, as compared with the conventional open clamshell. The dustpan head showed little advantage over the conventional cutterhead suction dredges. The basic sampling methodology used proved valid. (Cassar-PTT)
W86-03472

FIELD DREDGING TEST OF SOFT MUD LAYER BY A FRONT-OPEN TYPE DRAG HEAD,
Y. Irie.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 8th U.S./ Japan Experts Meeting, November 8-10, 1982, Tokyo, Japan. July 1984. p 326-380, 46 fig, 19 tab, 7 ref.

Descriptors: *Water quality control, *Dredging, *Sediments, Harbors, Chiba Port, Nagoya Port, Mikawa Port, Japan, Bottom sediments, Clays, Turbidity.

Field dredging tests using a front open drag head were carried out in closed harbors. This equipment was designed to dredge soft mud, dredging thinly and widely, in high density. Three tests were carried out--in Chiba Port, Nagoya Port, and Mikawa Port. Sediments were silty clays or clayey silts. Turbidity around the drag head was usually under 10 mg/liter in one test and usually under 30 mg/liter in the other tests. Since conditions were different in the three tests, results cannot be compared. However, information was obtained which permitted further improvements in dredge design and operation. (Cassar-PTT)
W86-03473

OVERVIEW OF A DREDGING DEMONSTRATION IN CONTAMINATED MATERIAL, JAMES RIVER, VIRGINIA,
Army Engineer District, Norfolk, VA.
R. E. Hudson, and R. G. Vann.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 8th U.S./ Japan Experts Meeting, November 8-10, 1982, Tokyo, Japan. July 1984. p 312-325, 4 fig, 3 ref.

Descriptors: *Water quality control, *Dredging, James River, Virginia, Kepone, Insecticides, Sediments, Monitoring, Channels, Suspended solids, Water pollution prevention, Dustpan dredge, Cutter suction dredge, Rivers.

The James River, Virginia, is a tributary of the Chesapeake Bay polluted with the toxic pesticide Kepone. The Norfolk District of the Corps of Engineers accomplished maintenance dredging operations within the polluted portion of the James River channel during fiscal year 1982. As part of the channel maintenance, the District conducted a demonstration of a dredging method designed to contain and remove a polluted layer of sediment with a minimum of resuspension. The method involved modifying and fitting an existing dustpan suction head to a contractor's cutterhead dredge. The dredge was then operated using an anchoring and maneuvering wire arrangement that enabled precise positioning of the suction head within the specified layer of polluted sediment. Monitoring of operating parameters on board the dredge, of resuspension at the suction head, and of water quality around the dredge and disposal area was accomplished with appropriate equipment. The dredge was also operated in the conventional cutterhead configuration for comparison with the dustpan arrangement. The data gathered during this demonstration project permitted evaluation of the dredging and disposal methods utilized and will be useful in planning future projects in the James River and other sites involving polluted dredged material. (Author)
W86-03474

EMERGENCY RESPONSE EQUIPMENT TO CLEAN UP HAZARDOUS CHEMICAL RELEASES AT SPILLS AND UNCONTROLLED WASTE SITES,
Municipal Environmental Research Lab.-Cincinnati, Edison, NJ. Solid and Hazardous Waste Research Div.
I. Wilder.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 8th U.S./ Japan Experts Meeting, November 8-10, 1982, Tokyo, Japan. July 1984. p 262-280, 12 fig, 33 ref.

Descriptors: *Water quality control, *Water pollution prevention, *Hazardous materials, Oil spills, Chemical spills, Wastewater treatment, Monitoring, Diversion, Streams, Incineration, Activated carbon, Adsorption, Soil treatment, Disasters, Chemical wastewater, Waste disposal.

This paper reviews some of the research activities of the U.S. Environmental Protection Agency (EPA) regarding the development of emergency response equipment to control hazardous chemical releases. Several devices and systems have been developed by EPA for environmental emergencies involving spills and uncontrolled waste sites. Many of these have already been made available commercially by industry, including a mobile physical/chemical treatment system for processing contaminated water at hazardous incidents and a mobile laboratory for onsite chemical analyses. Other operationally ready devices addressed in this paper include: a mobile stream diversion system for isolating segments of small streams to facilitate the removal of contaminated sediments; a portable back-pack polyurethane foam diking system for the containment of spilled chemicals; and an acoustic emission-based spill alert device for detecting imminent dike failure at lagoons containing toxic and hazardous wastes. Prototypical equipment, described in this paper, which are now undergoing shakedown testing and evaluation include a mobile soils washing system for extracting spilled materials from excavated soils onsite and a mobile, field-use incineration system for the thermal destruction of toxic organic compounds. (Author)
W86-03476

REVIEW OF CONTROL MEASURES FOR OBJECTIONAL ALGAL 'BLOOMS',
Montana Univ., Missoula.
G. W. Prescott.
IN: Proceedings of Workshop on Algal Management and Control, March 9-12, 1980, Pacific Grove, CA. Technical Report E-81-7, May 1981. Final Report. Army Engineer Waterways Experiment Station, Vicksburg, MS. p 5-14, 35 ref.

Descriptors: *Biocontrol, *Algal control, *Algal toxins, *Algicides, *Nuisance algae, Algae, Antibiotics, Copper sulfate, Eutrophication, Taste, Water quality management, Odor, Nutrients, Viruses, Pesticides.

Algae have been responsbile for bad taste and odor in some water supplies. The earliest attempts to purify water of algae may have been in the 1800's when potassium permanganate was used as a cidal agent against both bacteria and algae. The effectiveness of Cu as an algicide was discovered in France and Germany in the late 19th century. It was used in the United States in the early 1900's. After World War II, the United States government began to investigate the effectiveness of different chemicals as algicides. Many chemical companies have prepared algicides for commercial dispensing under trade names during the last 25 years. In recent years, algicidal research has concentrated on biocontrol agents. Cyanophages which are toxic to blue-green algae are generally widely distributed, especially in sewage lagoons. Bacterial parasitism and antibiotics are highly specific control agents that are being studied for algal control. Starvation or the reduction of phosphorus and nitrogen nutrients eventually reduces algal floras. At present, the chemical control methods still remain the most successful and practical, and copper sulfate, one of the least expensive methods for the control of algae in lakes and reservoirs. (Geiger-PTT)
W86-03484

SELECTIVE ALGICIDES,
Algae Acres, McFarland, WI.
G. P. Fitzgerald.
IN: Proceedings of Workshop on Algal Management and Control, March 9-12, 1980, Pacific Grove, CA. Technical Report E-81-7, May 1981. Final Report. Army Engineer Waterways Experiment Station, Vicksburg, MS. p 15-31, 5 tab, 22 ref.

Descriptors: *Algal control, *Algicides, *Copper sulfate, *Chlorine, *Chemcontrol, Pesticides, Algal blooms, Reservoirs, Ponds, Lakes, Swimming pools, Algae, Biodegradation, Nuisance algae, Chlorophyta, Cyanophyta.

Algae may cause problems in fish ponds by fouling fish harvesting nets or causing oxygen depletion which results in fish kills. In reservoirs, algae may cause obnoxious tastes or odor problems. Large algal blooms may cause the closing of beaches or swimming areas. Methods for selecting algicides should be simple procedures that are specific for the type of algae to be controlled. The algae causing problems in lakes and ponds have been found to be particularly sensitive to the toxicity of copper. The algae causing problems in swimming pools are best controlled by halide compounds, usually chlorine or bromine. Quaternary ammonia products may also be used. Copper sulfate has been the chemical of choice for control of algae in lakes, ponds, and reservoirs. As an alternative, potassium permanganate may be used. The effectiveness of algicidal or algistatic chemicals can be evaluated in laboratory or field tests. Chemicals used to control algae can be tested for detoxification (biodegradation) by simple modifications of algicidal or algistatic test procedures. All chemicals to be added to aquatic environments should be evaluated to determine if they will be biodegraded or remain in toxic condition to pollute the environment. (Geiger-PTT)
W86-03485

STATE-OF-THE-ART SUMMARY OF PHOSPHORUS INACTIVATION AS A LAKE RESTORATION TECHNIQUE,
Kent State Univ., OH. Dept. of Biological Sciences.
G. D. Cooke, and R. H. Kennedy.
IN: Proceedings of Workshop on Algal Management and Control, March 9-12, 1980, Pacific Grove, CA. Technical Report E-81-7, May 1981. Final Report. Army Engineer Waterways Experiment Station, Vicksburg, MS. p 32-56, 4 fig, 1 tab, 27 ref.

Descriptors: *Lake restoration, *Nutrient removal, *Phosphorus removal, *Algal control, *Aluminum sulfate, Nutrients, Aluminum, Phosphorus, Algal blooms, Algae, Nuisance algae, Trophic level, Lakes, Case studies.

The addition of aluminum sulfate and/or sodium aluminate, is a lake restoration technique often called nutrient inactivation or precipitation. Al salts are effective in removing inorganic and particulate P and can therefore accelerate improvement in lake trophic state. Two approaches for the addition of Al salts to lakes may be used. The amount of Al which can be added is directly related to lake alkalinity. The addition of Al for the purpose of controlling P release from sediments is the approach of choice for control of algal biomass. Al salts have commonly been applied in both surface and hypolimnetic treatments by barge. Five case studies of lake treatments are reviewed to illustrate the range of procedures available. No apparent toxicity of Al to fish or benthic invertebrates are reported; however, a decline in species diversity of planktonic microcrustacea was noted after Al treatment in West Twin Lake, Ohio. No long-term monitoring effects are available. The technique for lowering P concentration to the point of exerting control of algal biomass appears to be a successful one, although the longevity of effectiveness is not known. (Geiger-PTT)
W86-03486

CONTROL OF NON-POINT NUTRIENT CAUSED ALGAL PROBLEMS ESPECIALLY BY DILUTION,

Washington Univ., Seattle. Dept. of Civil Engineering.
E. B. Welch.
IN: Proceedings of Workshop on Algal Management and Control, March 9-12, 1980, Pacific Grove, CA. Technical Report E-81-7, May 1981. Final Report. Army Engineer Waterways Experiment Station, Vicksburg, MS p 98-120, 3 fig, 8 tab, 25 ref.

Descriptors: *Nonpoint pollution sources, *Nutrients, *Water quality management, *Storm sewers, *Algal control, Watershed management, Phosphorus, Lakes, Nitrogen, Surface waters, Algae, Phosphorus removal, Nuisance algae.

Non-point sources of nutrients that lead to nuisance algae blooms can theoretically be controlled by prevention of excessive development in watersheds thus keeping phosphorus yields below critical limits for the lake in question. Treatment of runoff in wetland areas appears promising; however, there is little evidence to suggest that retention ponds are effective at removing phosphorus and nitrogen. Diversion of stormsewers has been proposed and implemented and should be effective if nutrient concentration in the inflow is high, thus being analogous to sewage effluent diversion. Dilution of non-point sources of nutrients has been successful in at least two situations and has shown enough promise in at least five other instances in the West to be proposed. Lake quality in Moses and Green Lakes, Washington, improved by over 70 and 50 percent, respectively, in terms of chlorophyll a, total phosphorus and visibility. This occurred as a result of dilution rates on the order of 0.5 to 1.0 percent per day during the spring summer growth period - about ten times the normal rates. Dilution of allelopathic excretory products appears to have more merit as a cause for inhibition of blue-greens and favoring diatoms than does the decrease in nutrient content. If so, the addition of even relatively rich water could benefit lake quality. (Author)
W86-03488

LIMITS TO THE CONTROL OF ALGAL POPULATIONS BY GRAZING ZOOPLANKTON: THE ENVIRONMENTAL THEATER AND THE ECOLOGICAL PLAY,
Georgia Univ., Athens. Dept. of Zoology.
K. G. Porter.
IN: Proceedings of Workshop on Algal Management and Control, March 9-12, 1980, Pacific Grove, CA. Technical Report E-81-7, May 1981. Final Report. Army Engineer Waterways Experiment Station, Vicksburg, MS. p 121-130, 1 fig, 2 tab, 7 ref.

Descriptors: *Grazing, *Zooplankton, *Algal control, *Food chains, *Species diversity, Nutrients, Phosphorus, Algae, Species composition, Protozoans, Rotifers, Aquatic populations, Eutrophication, Lake restoration, Ecology.

Grazing zooplankton can control algae that are palatable to them and within a manageable size range. Selective grazing can shift the relative abundance among algal species in a community as demonstrated in in situ manipulation studies. Within limits, grazers can also determine algal abundance and community composition. Mild cases of eutrophication are inhibited by algal filaments while copepod populations increase. Intense eutrophication may cause elimination of larger grazers and promotion of smaller microzooplankton (rotifers and protozoans). Future research to manage algal-zooplankton systems should include examining the food particle spectrum and the role of bacteria and detritus in aquatic food chains, including microzooplankton in analyses of plantonic community composition, determining local and regional variability in algal-zooplankton interactions and developing quick methods for determining grazing potential on the available particle spectrum. (Geiger-PTT)
W86-03489

ALGAL CONTROL THROUGH TROPHIC-LEVEL INTERACTIONS: A SUBTROPICAL PERSEPCTIVE,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
T. L. Crisman.
IN: Proceedings of Workshop on Algal Management and Control, March 9-12, 1980, Pacific Grove, CA. Technical Report E-81-7, May 1981. Final Report. Army Engineer Waterways Experiment Station, Vicksburg, MS. p 131-145, 6 fig, 33 ref.

Descriptors: *Algal control, *Grazing, *Zooplankton, *Nuisance algae, *Biocontrol, Phytoplankton, Daphnia, Eutrophication, Crustaceans, Algae, Water quality management, Lakes, Fish, Species composition, Aquatic populations, Aquatic animals, Trophic level.

Numerous investigators have proposed that the composition and abundance of algal populations can be controlled biologically through a manipulation of the community structure of phytoplankton consumers such as macrozooplankton, but the feasibility of this approach has not been evaluated for subtropical zooplankton such as large species of Daphnia exerting a major control over phytoplankton. Subtropical systems are more complex due to the absence of large kaphnids and the domination of fish faunas in eutrophic lakes by phytophagous taxa including shad. It is suggested that management schemes for the biological control of phytoplankton consider regional differences in both the structure of grazer communities and the major 'nuisance' phytoplankton species. Construction of regional rather than a national management scheme for the biological control of algae should be stressed. (Author)
W86-03490

EXTRACELLULAR METABOLITE INVOLVEMENT IN PLANKTON COMMUNITY STRUCTURE,
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
For primary bibliographic entry see Field 2H.
W86-03491

CYANOPHAGES: ARE THEY POTENTIAL BIOLOGICAL CONTROL AGENTS OF NUISANCE BLUE-GREEN ALGAE,
California Univ., Riverside. Dept. of Plant Pathology.
For primary bibliographic entry see Field 2H.
W86-03492

UTILIZATION OF BACTERIA IN MANAGING CYANOBACTERIAL POPULATIONS: A REVIEW AND UPDATE,
Medical Coll. of Ohio at Toledo. Dept. of Microbiology.
For primary bibliographic entry see Field 2H.
W86-03493

ALGICIDES AND ALGAL MANAGEMENT AND CONTROL: BIBLIOGRAPHY,
Montana Univ., Missoula.
G. W. Prescott.
IN: Proceedings of Workshop on Algal Management and Control March 9-12, 1980, Pacific Grove, CA. Technical Report E-81-7, May 1981. Final Report. Army Engineer Waterways Experiment Station, Vicksburg, MS. p 259-299.

Descriptors: *Bibliographies, *Algicides, *Algal control, Biocontrol, Antibiotics, Nutrients, Algae, Copper sulfate, Grazing, Fish, Pesticides, Chemical treatment.

A bibliography for algicides and algal management and control includes a subject index that is divided into several sections: chemical control by agents other than copper sulfate, and general reports; biological and natural control; physical control; methods of application of chemicals (techniques); cold weather treatment; and other literature. The section on biological and natural control includes references to works on topics of viral and bacterioloical control agents, antibiotics and extrametabolites, grazing (fish and microfauna), and nutrient management. (Geiger-PTT)
W86-03494

GROUNDWATER MANAGEMENT STRATEGY FOR MICHIGAN: PUBLIC NOTIFICATION METHODS.
Michigan Dept. of Natural Resources, Lansing. Water Quality Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-132662, Price codes: A03 in paper copy, A01 in microfiche. MI/DNR/GW-82/08, July 1982. 28 p, 5 append. P00558801.

Descriptors: *Information systems, *Groundwater, Groundwater management, Water quality, Water pollution, Water quality management, Groundwater pollution, Public health, Public alerting.

Several thousand sites in Michigan have been identified as areas of potential groundwater contamination. The need for an effective system of informing the users of contaminated groundwater supply wells of the dangers associated with continued consumption of their groundwater is stressed. A comprehensive public alerting system consists of two categories of notification methods: short-term notification and long-term notification methods are used to immediately alert the users of a contaminated water supply well. Long-term notification methods are intended to ensure that people do not unknowingly utilize contaminated groundwater at any time after a problem has been detected and initial notification taken place. This report documents current formal and informal methods that are used in Michigan for both short-term and long-term notification of groundwater contamination problems and their consequences. As a result of this documentation, problem areas are identified and recommendations are presented. (Halterman-PTT)
W86-03513

DIRTY DEVIL PROJECT: CLASS II CULTRAL RESOURCES INVENTORY IN CENTRAL UTAH,
P-III Associates, Inc., Salt Lake City, UT.
For primary bibliographic entry see Field 6G.
W86-03518

PERFORMANCE OF SANITARY COMPLETION MEASURES OF WELLS AND BOREHOLES USED FOR RURAL WATER SUPPLIES IN MALAWI,
Department of Lands, Valuation and Water, Lilongwe (Malawi).
W. J. Lewis, and P. J. Chilton.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 235-247, 5 fig, 1 tab, 12 ref.

Descriptors: *Water quality control, *Water pollution sources, *Wells, *Boreholes, *Water supply, Bacterial analysis, MMalawi, Coliforms, Streptococci, Rural areas, Fate of pollutants, Dug wells, Shallow wells, Microbiology, Protection, Seasonal variation.

A microbiological testing program was conducted on the plateau of central Malawi during both dry and wet seasons. Fecal coliforms and fecal streptococci per 100 ml, respectively, were less than 10 and 20 in boreholes and less than 20 and 50 in protected dug wells. However, some lined dug wells, olde boreholes, and about 50% of the unprotected wells had fecal coliform levels in excess of 500 per 100 ml. In the wet season fecal streptococci levels remained below the 20 per 100 ml standard in 59% of backfilled dug wells, 41% of non-backfilled dug wells, and 85% of boreholes. Some possible reasons for the inferior water quality of dug wells as compared with boreholes are (1) water tables of less than 2 m, (2) presence of fissures in the clay dambo soils, voids from plant roots and animal burrows, (3) proximity to livestock watering and grazing, and (4) frequent siting near grossly polluted traditional water sources. The most appropriate defense against pollution of

shallow groundwater supplies are proper siting and good sanitary completion (backfilling, etc.).
W86-03582

WATER RESOURCE DATA AND TREND ANALYSIS FOR THE BLUE CREEK WATERSHED PROJECT, PIKE COUNTY, ILLINOIS: PHASE II,
Illinois State Environmental Protection Agency, Springfield. Div. of Water Pollution Control.
T. E. Davenport.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-119917, Price codes: A08 in paper copy, A01 in microfiche. IEPA/WPC/82-0082, September 1982. 161 p, 7 fig, 54 tab, 12 app, 86 ref.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Illinois, *Water quality, Flow rate, Gaging stations, Sampling sites, Chemical analysis, Water analysis, Water levels.

The Illinois Environmental Protection Agency (EPA) in cooperation with the United States Department of Agriculture Agencies, Agricultural Stabilization and Conservation Service (ASCS), Cooperative Extension Service (CES) and Soil Conservation Service (SCS), is evaluating the impact of Resource Management Systems (RMS's) implemented under the ACP Special Water Quality Project in the Blue Creek Watershed, Pike County, Illinois. The primary objectives of this project are to identify the most viable agricultural non-point source control strategy, demonstrate its effectiveness, develop a methodology to identify land causing water quality problems and to determine the appropriate RMS's. The physical, biological, and chemical characteristics of the Blue Creek watershed were studied since May, 1980. A comprehensive monitoring network for the entire Blue Creek Watershed was established by IEPA to document the basic hydrological, meterological, and water quality factors of the project area during 1980. The duration, timing and quantity of NPS pollutants were evaluated to determine land management effects on the water quality/quantity budget. Methods used for field and laboratory procedures are those accepted for agricultural related hydrology research. Analytical techniques are documented, but not detailed. By October 1, 1981, 70% of the soil loss reduction goal had been achieved, and erosion had been reduced by 16,495 tons/year. Precipitation was 17.5% above normal, with variability of streamflow attributed primarily to the precipitation patterns and land cover. High flows were measured from February through June while lower flows were measured during July and August. The rainfall-runoff ratio ranged from 4.7% to 80.1% during July and averaged 41.4% for Water Year 1981. Water samples were collected at seven stations in the Blue Creek Watershed during Phase II of the project, with three types of stations located within the watershed: watershed stations (A,B,C) sub-basin D and field stations (E,F,J).
W86-03610

CANADIAN INLAND WATERS: COASTAL ENVIRONMENTS AND THE CLEANUP OF OIL SPILLS,
Woodward-Clyde Consultants, Victoria (British Columbia).
E. H. Owens.
EPS 3-EC-82-3, July 1982. Department of the Environment, Ottawa (Ontario). 33 p, 11 fig, 8 tab, 4 ref.

Descriptors: *Oil spills, *Shore protection, *Environmental protection, *Fate of pollutants, *Water quality control, Cleanup operations, Lake shores, Rivers, Inland waterways, Protection, Water level, Beaches, Waves, Wind waves, Canada, Water pollution sources, Water pollution prevention.

Guidelines for shoreline protection and cleanup after oil spills in inland waters (lakes and rivers) are presented. Part I describes the spill and environmental information necessary to evaluate the spill impact and environmental sensitivity. Important factors in evaluating the impact and persistence of stranded oil are shoreline type (e.g., mud, sand, vegetation, rock, man-made) and energy levels as affected by waves, water level, wind, and ice. Part II discusses methods of protection and cleanup for each shoreline type. Decision guides are given for various substrates and conditions. Five checklists help to organize the spill and environmental information and to assess shoreline sensitivity, protection methods, and cleanup methods. Among the 23 cleanup methods are use of mechanical equipment (bulldozer, dragline, etc.), flushing, steam cleaning, sandblasting, pumping and vacuum, manual removal, burning, and natural degradation.
W86-03621

EVALUATION OF OIL SKIMMERS AND PUMPS,
Environmental Protection Service, Ottawa (Ontario).
Report EPS 4-EC-81-4, December 1981. 78 p, 13 fig, 12 tab, 9 plates, 16 ref, 3 append.

Descriptors: *Oil skimmers, *Oil recovery, *Pumps, *Evaluation, Oil slicks, Oil, Field tests, Cleanup operations.

A series of laboratory trials was conducted in the test tank of Arctec Canada Ltd., Ontario, in order to evalute five oil skimmers and a number of related devices. Test were conducted using Venezuelan crude and diesel oils, at oil slick thicknesses of 1 to 10 mm. The program included two stationary skimmers; one remotely controlled semistationary skimmer; two mobile machines (one towed unit and one completely selfconducted skimmer package); and two pumps. The actual oil recovery rate of the oleophilic stationary skimmers evaluated by this test program was closely related to the oil spreading characteristics as well as to the operating characteristics of the skimmer itself. The oil content factor of the oleophilic skimmers was very high and the use of a small settling tank for a short period of time did not noticeably improve the oil content factor of the liquid recovered. Booming off a slick of approximately 2 to 5 mm improved not only the actual oil recovery rate, but the oil content factor of the recovered liquid as well. For oil slick thicknesses of <2 mm, the water content factor increased rapidly, especially in crude oil. The use of a small separator of 1000 l/min was only good for a weir type of skimmer, where the oil content factor was low. A positive displacement pump (preferably multi-chambered) designed for field use was the most adequate transfer pump for oil cleanup operations.
W86-03625

OIL STOP VALVE: OIL SPILL CONTAINMENT RESEARCH AND DEVELOPMENT PROJECT,
Bonneville Power Administration, Portland, OR.
R. D. Bourn.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-019262. Price codes: A02 in paper copy, A01 in microfiche. DOE/BP-121, July 1982. 15 p, 2 fig, 6 app, 25 ref.

Descriptors: *Oil spills, *Water quqlity control, *Valves, *Stormwater, *Powerplants, Oil skimmers, Environmental protection, Floats, Bonneville Power Administration, AFL/Clark Industries, Wate r treatment.

An oil stop valve, produced by AFL/Clark Industries, was tested for use in the Bonneville Power Administration's Oil Spill Containment and Countermeasure Program. The small, direct-acting valve can be used independently or with separator tanks and lagoon systems. Its only moving part is a ballasted float having a specific gravity between that of oil and water. When oil enters the water, usually in a manhole, the float seats itself, closing the valve and allowing the oil to back into a drain. Tests of a 4-inch valve led to modifications and construction of 8-inch and 12-inch models. The 12-inch valve has a 1400 gal per min capacity. Small twigs and leaves do not interfere with the valve's operation or impede water flow. The valve's major limitation is it inability to reopen once closed by a intrusion of oil. Since an automatically opening valve of this size cannot be practically constructed, the valve must be inspected regularly for closure due to oil accumulation or water evaporation.
W86-03627

EVALUATING CHANGES IN DIKE FIELD FISHES WITH COMMUNITY INFORMATION INDICES,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 7A.
W86-03628

CONSEQUENCE ASSESSMENT OF HYDROLOGICAL COMMUNICATIONS THROUGH BOREHOLE PLUGS,
INTERA Technologies, Inc., Houston, TX.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-011242, Price codes: A03 in paper copy, A01 in microfiche. Techincal Report 771-00G-02, August 10, 1981. 28 p, 8 fig, 10 ref, 2 append. DE-AC04-76DP00789.

Descriptors: *Boreholes, *Radioactive waste disposal, *Fate of pollutants, *Aquifers, *Permeability, *Geohydrology, *Waste disposal, *Groundwater movement, Leaching, Plugs, Waste Isolation Pilot Plant, New Mexico, Hydraulic permeability, Rustler formation, Delaware Mountain formation, Conductance, Hydrologic aspects, Water flow, Underground waste disposal.

Plugging boreholes in a nuclear waste repository with very low permeability plugs is probably not essential to contain the radioactive wastes in the Waste Isolation Pilot Plant, southeast New Mexico. Four hypothetical cases of hydrological communication between aquifer(s) and repository are considered: (1) the U-tube scenario, two wellbores and/or shafts connecting aquifer and repository; (2) a single borehole running through an upper aquifer, the repository, and a lower aquifer; (3) similar to (1) but with multiple boreholes; (4) similar to (2) but with multiple boreholes. Above a borehole conductance of 100 md-ft the borehole conductance approaches a constant rate between 14-260 cu ft per day for the four cases studied. Flow through the repository depends on aquifer connection, plug conductance, borehole distribution, and regional aquifer hydraulic gradient and permeability. Flow rates are greater for the two-aquifer connection than for the one-quifer connection. Flow rates are greater for multiple boreholes than for a single borehole but do not increase linearly with the number of boreholes.
W86-03629

STATUS REPORT ON COMPLIANCE WITH THE CHLOR-ALKALI MERCURY LIQUID EFFLUENT REGULATIONS 1980-81,
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
For primary bibliographic entry see Field 5E.
W86-03633

NONPOINT NITRATE POLLUTION OF MUNICIPAL WATER SUPPLY SOURCES: ISSUES OF ANALYSIS AND CONTROL,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-119222, Price codes: A14 in paper copy, A01 in microfiche. Proceedings of an IIASA Task Force Meeting, February 10-12, 1982, Laxenburg, Austria. Series No. CP-82-S4, 1982. Karl-Heinz Zwirnmann, editor. 302 p.

Descriptors: *Nitrates, *Nonpoint pollution sources, *Agriculture, *Fertilizers, *Water quality control, *Water pollution prevention, Water supply, Water pollution sources, Fate of pollutants, Leaching, Drinking water, Groundwater pollution, Agricultural chemicals, Municipal water, Nitrogen compounds.

The Resources and Environmental Area of the International Institute for Applied Systems Analysis is concerned with nonpoint pollution of water resources by intensive agricultural activities, particularly use of chemical fertilizers. The exploratory study began with an analysis of the physical

system to be controlled (water resources, nitrogen input and output). A management system for controlling nitrate pollution included the system to be controlled (municipality, environment, water supply, and agricultural production), management objectives, and the management subsystem. Papers presented at the Task Force meeting were of three types: identification of the problem, control options, and methodology-oriented approaches.
W86-03649

EFFECTS OF REGIONAL WATER MANAGEMENT ON N-POLLUTION IN AREAS WITH INTENSIVE AGRICULTURE,
Instituut voor Cultuurtechniek en Waterhuishouding, Wageningen (Netherlands).
P. E. Rijtema.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-119222, Price codes: A03 in paper copy, A01 in microfiche. In: Nonpoint Nitrate Pollution of Municipal Water Supply Sources: Issues of Analysis and Control, Proceedings of an IIASA Task Force Meeting, February 10-12, 1082, Laxenburg, Austria. Series No. CP-82-S4, 1982. p 15-42, 8 fig, 5 tab, 9 ref.

Descriptors: *Nitrates, *Nonpoint pollution sources, *Agriculture, *Wells, *Drainage effects, *Water management, *Land use, *Water quality control, Fertilizers, Deep wells, Fate of pollutants, Groundwater pollution, Municipal water, Water pollution sources. Aquifer management, Surface runoff, Runoff, East Gelderland, The Netherlands, Surface water, Phreatic level, Model studies, Nitrogen compounds.

Local drainage improvements do not extensively affect the net subsurface inflow of the groundwater aquifer in East Gelderland, an intensively cultivated agricultural region of The Netherlands. However, drainage channels, constructed to lower the phreatic level, reduce surface runoff and increase the discharge by interflow through the soil system. The resulting increase in residence time of the precipitation excess in the soil system permits additional denitrification, reducing the nitrogen load on the surface water. Deep well pumping for the muncipal water supply causes low-lying areas which do not normally drain into the groundwater aquifer to do so. Nitrate loads in the region vary widely, depending on hydrological conditions and land use. Inflow concentrations of nitrogen (in g per cu m) are assumed to be 10.7 from grasslands, 36.0 from arable land, 2.5 from forests, and 10.0 from urban areas.
W86-03650

IMPACT OF NITROGEN FERTILIZER APPLICATION ON THE NITRATE CONCENTRATION IN GROUNDWATER: COST-BENEFIT ANALYSIS CONSIDERATIONS,
Goettingen Univ. (Germany, F.R.).
H. de Haen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-119222, Price codes: A03 in paper copy, A01 in microfiche. In: Nonpoint Nitrate Pollution of Municipal Water Supply Sources: Issues of Analysis and Control, Proceedings of an IIASA Task Force Meeting, February 10-12, 1982, Laxenburg, Austria. Series No. CP-82-S4, 1982. p 57-80, 7 fig, 3 tab, 13 ref.

Descriptors: *Water quality control, *Nitrates, *Cost-benefit analysis, *Agriculture, *Fate of pollutants, *Nonpoint pollution sources, Benefits, Fertilizers, Economic aspects, Drinking water, Nitrogen compounds, Groundwater pollution, Federal Republic of Germany, Model studies, Water pollution prevention.

A cost-benefit analysis for dealing with the effect of nitrogen fertilizer application on nitrate concentration of groundwater is developed, using data collected in the Federal Republic of Germany. Graphs show the relationships between costs of reducing nitrate levels in drinking water vs. benefits (prevention of damage to health). From this, an acceptable nitrate concentration limit can be chosen. Nitrate flows in soils and aquifers are modeled. An economic analysis at the catchment level is proposed. Results of this type of study can be used to formulate policies for managing nitate pollution, for example, regulation of crop type or taxation of fertilizer use.
W86-03652

POSSIBILITIES OF CONTROLLING NITRATE CONCENTRATIONS IN DRINKING WATER,
M. Roman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-119222, Price codes: A02 in paper copy, A01 in microfiche. In: Nonpoint Nitrate Pollution of Municipal Water Supply Sources: Issues of Analysis and Control, Proceedings of an IIASA Task Force Meeting, February 10-12, 1982, Laxenburg, Austria. Series No. CP-82-S4, 1982. p 117-134, 8 tab, 13 ref.

Descriptors: *Drinking water, *Nitrates, *Water quality control, *Nonpoint pollution sources, *Water treatment, Municipal water, Nitrogen compounds, Stormwater, Poland, Surface water, Vistula River, Runoff, Ammonia, Nitrites, Organic nitrogen, Groundwater pollution, Rivers, Water pollution sources.

The problem of nitrates in drinking water should also take account of organic nitrogen, ammonia, and nitrites, which may be transformed to nitrates under certain conditions. Three integrated nonpoint sources of nitrogen pollution are identified and described in detail as studied in Poland: (1) stormwater, (2) soil, and (3) surface runoff. The nitrate level in drinking water supplies for large Polish cities is no problem. The highest levels, found in only three cities, were 5-10 mg N-NO3 per liter. However, some small local water supply systems based on shallow groundwater had over 100 mg N-NO3 per liter. River water tends to be higher in organic nitrogen and ammonia compounds. Since traditional water treatment is not effective in eliminating nitrates, several 'non-treatment' methods, such as a dual-quality water supply system, are suggested.
W86-03653

POSSIBILITIES OF WATER MANAGEMENT FOR PROTECTING AND TREATING DRINKING WATER RESOURCES IN CASE OF NITRATE POLLUTION,
D. Lauterbach, and H. Klapper.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-119222, Price codes: A03 in paper copy, A01 in microfiche. In: Nonpoint Nitrate Pollution of Municipal Water Supply Sources: Issues of Analysis and Control, Proceedings of an IIASA Task Force Meeting, February 10-12, 1982, Laxenburg, Austria. Series No. CP-82-S4, 1982. p 135-161, 5 fig, 4 tab, 11 ref.

Descriptors: *Water management, *Water quality control, *Nonpoint pollution sources, *Nitrates, *Drinking water, Municipal water, Groundwater pollution, Water pollution prevention, Water treatment, Protection, Water pollution sources, Wastewater treatment, Nutrients, Algae, Denitrification, Reservoirs, Ion exchange, Infiltration.

This paper gives an overview of some of the methods for managing the nitrate problem from the point of view of water management. The main types of methods distinguished are those for reducing or preventing nitrate inputs into water bodies, for controlling or treating water bodies with too high a nitrate content, and treatment in water works. Within the first group mentioned, particular attention is given to the establishment of drinking water protection zones, while the discussion of the second group addresses methods such as hydralically controlling, or biologically treating surface water bodies. Ion exchange and artificial infiltration are recommended for implementation in water works. (Author)
W86-03654

MODELLING NITRATE POLLUTION IN WATER RESOURCE SYSTEMS: THE THAMES NITRATE PROJECT,
Thames Water Authority, London (England).
J. Blake.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-119222, Price codes: A02 in paper copy, A01 in microfiche. In: Nonpoint Nitrate Pollution of Municipal Water Supply Sources: Issues of Analysis and Control, Proceedings of an IIASA Task Force Meeting, February 10-12, 1982, Laxenburg, Austria. Series No. CP-82-S4, 1982. p 231-245, 6 fig, 2 ref.

Descriptors: *Water treatment, *Nitrates, *Drinking water, *Water quality control, Model studies, Thames River, Dentrification, Reservoir management.

The Thames Nitrates Project is a three-phase approach to the problem of rising nitrate concentrations in drinking water. The first two phases, problem identification and strategy development, are described. The mean annual nitrate concentration at Walton on the lower Thames increased from 4.2 mg N per liter in 1968 to 7.7 mg N per liter in 1979. For 62 days in 1976/1977 the concentration of nitrate was above the recommended limit of 11.3 mg N per liter. By the end of the century nitrate concentrations in this section of the Thames could reach 9.8-15.2 mg N per liter. Several options for nitrate management were developed: denitrifying sewage effluent, storing raw water for natural denitrification, blending high- and low-nitrate water, managing reservoirs, and installing denitrification plants at treatment works. This information will be modeled to ascertain an effective solution.
W86-03657

INTEGRATED PHYSICAL-ECONOMIC SYSTEMS ANALYSIS OF IRRIGATED AGRICULTURE,
California Univ., Davis. Dept. of Agricultural Economics.
D. J. Dudek, and G. L. Horner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-119222, Price codes: A04 in paper copy, A01 in microfiche. In: Nonpoint Nitrate Pollution of Municipal Water Supply Sources: Issues of Analysis and Control, Proceedings of an IIASA Task Force Meeting, February 10-12, 1982. Laxenburg, Austria. Series No. CP-82-S4, 1982. p 247-299, 20 fig, 3 tab, 15 ref.

Descriptors: *Nitrates, *Nonpoint pollution sources, *Irrigation effects, *Agriculture, *Economic analysis, *Water quality control, Nitrogen compounds, Model studies, Environmental effects, Social impact, Economic impact, Environmental protection, Planning, Water policy, Water management, Legislation, Land use, Resources management, San Joaquin Valley, California, Hydrologic models, Mathematical models, Drainage effects, Surface runoff, Tailwater, Scheduling, Water reuse.

This paper presents an integrated physical-economic methodology for the evaluation of nonpoint source pollution control technologies in an irrigated agricultural setting. The economic model determines the optimal allocation of resources and provides the capacity to assess the socio-economic impacts of nonpoint source control. Its physical counterpart estimates effects on the quality and quantity of groundwater as a result of the normative cropping pattern derived in the economic model. Four alternative control policies are then evaluated: continuation of current practices, mandatory tailwater recycling, mandatory irrigation scheduling, and recycling in concert with scheduling. Although the results presented emphasize the nitrate pollution of groundwater, the production of drainage effluent, salinity, surface runoff, and changes in subsurface drainage are also examined. Results are described in aggregate for the region by parameter and time period and by spatially differentiated production units. These results show the need for integrating the physical and socio-economic aspects of the agricultural production system within a single analytical methodology in order to generate policy relevant information. (Author)
W86-03658

POND MANAGEMENT: WATER QUALITY CRITERIA AND CONTROL,

Alabama Agricultural Experiment Station, Auburn.
W. D. Hollerman.
In: Aquaculture in Dredged Material Containment Areas: Proceedings, September 1982, Galveston, TX. Miscellaneous Paper D-83-2, October 1983. p 121-129, 3 fig, 1 tab, 28 ref.

Descriptors: *Water quality control, *Ponds, *Fish farming, *Aquaculture, *Dredging, *Aquatic habitats, *Fish ponds, Habitats, Dissolved oxygen, Oxygen, Aeration, Carbon dioxide, Water hardness, Alkalinity, Nitrites, Suspended sediments, Turbidity, Ammonia, Hydrogen ion concentration, Clays.

Proper management of water quality variables in aquaculture operations, including those in dredged material containment areas, is imperative if success is expected. Dissolved oxygen, perhaps the most critical factor in fish culture systems, can be managed with mechanical aeration. Carbon dioxide may be harmful to fish when oxygen concentrations are low. Hydrated lime is effective in removing carbon dioxide from water. An imbalance between calcium hardness values and alkalinity concentrations may cause high pH levels lethal to fish. Ammonia and nitrite often accumulate in aquaculture systems. A pond treatment of sodium chloride protects fish from nitrite toxicity. Filter alum may be used to remove colloidal clay particles from water, eliminating turbidity that may limit photosynthesis. (Author)
W86-03708

PHYTOPLANKTON EFFECTS OF RESERVOIR USE,
Tennessee Valley Authority, Chattanooga. Div. of Water Resources.
W. L. Poppe, J. S. Crossman, and S. W. Hixson.
In: Papers Presented at Workshop, April 10-12, 1979, Monterey, CA. Technical Report E-81-13, September 1981. p 263-275, 43 ref.

Descriptors: *Water quality control, *Lakes, *Reservoirs, *Taste, *Odor-producing algae, *Algae, *Eutrophication, *Nutrients, Geosmin, Musidone, Actinomycetes, Algicides, Zooplankton, Fish, Aeration, Ultrasound, Reservoir releases, Water treatment.

Taste and odor problems related to nuisance algae are reviewed, and control measures are suggested. Although algae were associated with bad taste and odor in water as early as 1897, the specific compounds were not identified until recently. These compounds, usually producing earthy or musty odors, are geosmin, musidone, and 2-exo-hydroxy-2-methylborane. Geosmin is produced by algae, actinomycetes, and some streptomycetes. In southwestern reservoirs actinomycetes have been blamed for taste and odor problems. A hypothesis was developed to explain that algal blooms and taste/odor problems do not always coincide. When algae are healthy, actinomycetes are controlled. However, under nutrient-limiting conditions the relationship shifts to a parasite-host type in which algae are the host. Of the biological control methods, viral algicides look more promising than use of zooplankton grazing or fish predation. Chemical control methods, which often are toxic to the whole aquatic system, include potassium permanganate and copper sulfate. Nutrient limitation can be accomplished by controlling point and nonpoint inputs, dilution with nutrient-poor water, and waste treatment. Mechanical means include ultrasonic radiation, shock waves, and destratification by aeration. Some management techniques have been helpful: use of multilevel water intakes, water treatment, and releasing a slug of hypolimnetic water (alters temperature and streamflow in downstream water).
W86-03722

PROBLEMS ON THE UPPER MISSISSIPPI RIVER AND ITS TRIBUTARIES: NEED FOR A LONG-TERM RESOURCE MONITORING PROGRAM,
Columbia National Fisheries Research Lab., La Crosse, WI. Field Research Station.
For primary bibliographic entry see Field 7A.
W86-03751

CHANGES IN GROUND-WATER CHEMICAL COMPOSITION IN DRAINED PEAT BOGS IN CONNECTION WITH ENVIRONMENTAL PROTECTION MEASURES,
Akademiya Navuk BSSR, Minsk.
For primary bibliographic entry see Field 2F.
W86-03764

VALIDATION AND PRIORITY POLLUTANT ANALYSIS,
Dow Chemical U.S.A., Midland, MI.
For primary bibliographic entry see Field 5A.
W86-03792

WYCOAL GAS COAL-GASIFICATION PROJECT; PRELIMINARY DRAFT ENVIRONMENTAL IMPACT STATEMENT, VOLUME 2.
Woodward-Clyde Consultants, San Francisco, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as DE83-001084. Price codes: A17 in paper copy, A01 in microfiche. DOE/RA/50404 -- 1232 -- AppQ-Vol 2, August 1981. 382 p, 10 fig, 40 tab, 340 ref, 5 append, glossary. DE-F-CO2-81RA50404.

Descriptors: *Water pollution control, *Pollution control, Water pollution effects, Environmental protection, Water pollution prevention, Water pollution sources, Coal, Coal gasification, Coal mines.

The environmental consequences (effects and impacts) of the proposed actions and alternatives, regarding the construction of a coal gas plant are discussed. Effects are defined as the changes or permutations caused by the proposed action or alternatives, but not the final or ultimate change. Impacts are the residual effects on the final or ultimate change. Discussions of the impacts from the project components (plant, water supply system, product pipeline, railroad and mine) are organized into construction, operation and maintenance, and abandonment phases. Energy efficiency analysis, health and safety, mitigation measures, monitoring programs, unavoidable adverse impacts are also discussed. (Halterman-PTT)
W86-03840

MANAGEMENT OF BOTTOM SEDIMENTS CONTAINING TOXIC SUBSTANCES: PROCEEDINGS OF THE 9TH US/JAPAN EXPERTS MEETING.
Army Engineer Inst. for Water Resources, Fort Belvoir, VA.
Held on October 17-19, 1983, Jacksonville, FL. March 1985. Edited by Thomas R. Patin. 244 p.

Descriptors: *Dredging, *Eutrophication, *Sediments, *Toxic wastes, Limnology, Toxicity, Dewatering, Model studies, Turbidity, Suspended solids, Oil pollution, Aquaculture.

The proceedings of a conference of dredging experts from the United States and Japan are presented. Experts from both countries present technical papers on a variety of subjects, including arresting and reversing eutrophication in both saltwater and freshwater water bodies, dewatering of dredged sediments, control and minimization of turbidity during dredging, management of dredged sediment disposal and containment activities, alternatives to ocean disposal of dredged sediments, effects of contaminated sediments on the chemical and biological environments, rehabilitation of contaminated water bodies, and constructive uses for dredged sediments. (Halterman-PTT)
W86-03867

AERATION EFFECTS ON MARINE EUTROPHICATION,
I. Yamashita, M. Shikamori, and T. Horie.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/Japan Experts Meeting. March 1985. p 8-26, 18 fig, 2 tab.

Descriptors: *Aeration, *Eutrophication, Phosphorus, *Toxic wastes, Toxicity, Phosphate, Destratification, Stratification, Shimizu, Japan.

The results of a study on the application of an aeration system to a marine environment are presented. A multi-hole, tube type aeration device was tested in a nearly closed sea area. This study, which includes preliminary studies, laboratory, and field experiments, and simulation studies, confirmed the effectiveness of the system with regard to destratification. However, more detailed studies and refinement of the methods are needed. Studies are needed on the effects of a system in which several types of air tubes are combined and operated in a wider sea area, the effects of longer operating time, the effects of intermittent operation, and the effects of differing air rates. (Halterman-PTT)
W86-03868

THEORETICAL CONSIDERATIONS OF GRAVITY DEWATERING OF DREDGED MATERIAL THROUGH THE BOTTOM OF A CONTAINMENT AREA,
Japan Bottom Sediment Management Association, Tokyo.
For primary bibliographic entry see Field 5D.
W86-03870

RAPID DEWATERING TEST OF DREDGED MATERIAL IN SITU,
Japan Bottom Sediment Management Association, Tokyo.
For primary bibliographic entry see Field 5D.
W86-03871

MECHANICAL DEWATERING OF DREDGED SLURRIES,
Rexnord, Inc., Milwaukee, WI.
For primary bibliographic entry see Field 5D.
W86-03872

THEORETICAL CONSIDERATION OF POND AND SPILLWATER TREATMENT DESIGN,
Japan Bottom Sediment Management Association, Tokyo.
Y. Yoshida, and M. Natori.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/Japan Experts Meeting. March 1985. p 132-144, 7 fig.

Descriptors: *Dredging, *Dewatering, Sludge drying, Spoil banks, Pollution, Sediments, Sedimentation, Settling basins.

The importance of correctly evaluating laboratory tests for determining pond design or spill water treatment design is discussed. Theoretical considerations of sedimentation testing (including precipitation curves and descending clarified liquid surfaces), settling velocity, swelling of dredged material, suspended solids removal coefficient, and removal of pollutants, are presented. Although the settling tube test is the most popular method for planning settling ponds and spill water treatment, there is some question about the correct evaluation of test results. The theoretical analysis presented here will hopefully be useful in making correct evaluations. (Halterman-PTT)
W86-03876

REHABILITATION OF ESTUARIES IN TSUMATSUSAKA HARBOR,
S. Hamaguchi.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/Japan Experts Meeting. March 1985. p 198-209, 12 fig, 3 tab.

Descriptors: *Dredging, *Sedimentation, *Toxic wastes, Suspended sediments, Spoil banks, Pollution, Turbidity, Toxicity, Chemical composition, Harbors, Japan.

To improve the water quality of Matsusaka Harbor, Japan, it was necessary to remove the

polluted sediments from the Shitomo and Iwata Rivers, which flow into the harbor. The removal criteria, depth of dredging, disposal of dredged materials, deodorization, and spill water treatment are discussed. The most important factor considered in determining the depth of sediment removal was the sulfide concentration vertical profile. Sediments with sulfides greater than 1 mg/mg were removed, which meant dredging to a depth of 4.5 m in the lower portion of the Shitomo River. Turbidity was controlled with the use of silt curtains deployed above and below the dredging sites. After completion of the dredging work in the Shitomo River, the foul odors disappeared completely, and numbers of water birds, fish and shellfish increased. (Halterman-PTT)
W86-03880

PROCEEDINGS OF THE CONFERENCE ON COMBINED MUNICIPAL/INDUSTRIAL WASTEWATER TREATMENT.
Robert S. Kerr Environmental Research Lab., Ada, OK.
For primary bibliographic entry see Field 5D.
W86-03883

MINIMIZING COSTS BY GOOD FINANCIAL MANAGEMENT,
Synthetic Organic Chemical Manufacturers Association, Inc., Washington, DC.
For primary bibliographic entry see Field 6C.
W86-03886

WATER POLLUTION: INDUSTRY AND GOVERNMENT WORKING TOGETHER - A CASE STUDY OF MUNCIE, INDIANA'S INDUSTRIAL PRETREATMENT PROGRAM,
For primary bibliographic entry see Field 5A.
W86-03898

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

WATER 2000, VOLUME IX: PLAN MANAGEMENT SUMMARY,
New Castle County Water Resources Agency, DE.
November 1984. 57 p. 8 Ref, 2 Append.

Descriptors: *Water management, Resources management, *Future planning, *Projections, Policy making, Public policy, Administrative agencies, Data collections, Project planning, Multiobjective planning, Long-term planning, Management planning.

This is the ninth and last volume in the WATER 2000 Plan, which is a cooperative planning effort to meet the water needs of New Castle County residents to the year 2000 and beyond. These reports contain four integrated management strategies--Demand Management, Facility Management, Resource Management and Plan Management--each of which has been divided into its pertinent key issues. This report summarizes the first eight reports and also formulates the management policies necessary to administer, review and revise WATER 2000 throughout the planning period. The two main management concerns are the administrative structure including the responsibility and authority of all parties, and the informational requirements for monitoring the plan. Based on a discussion of those considerations six Plan Management recommendations are made: (1) revise the Memorandum of Understanding between the state and other concerned county and local agencies; (2) establish a New Castle County management council to coordinate the activities of the multiple parties involved; (3) prepare an annual Water Resources Agency program and budget; (4) re-establish a Water Resources Advisory Committee to assist the WRA in implementing the WATER 2000 Plan; (5) complete an annual Water Resources Review and Report to analyze resource availability, capabilities, demand and results; and (6) prepare a WATER 2000 plan revision every five years. Implementation procedures are outlined for each of the recommendations. (Atkins-Omniplan)
W86-03435

NONLINEAR PROGRAMMING MODEL OF A WASTEWATER TREATMENT SYSTEM: SENSITIVITY ANALYSIS AND A ROBUSTNESS CONSTRAINT,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W86-03511

AFRICAN GROUNDWATER DEVELOPMENT-THE CHALLENGES FOR HYDROGEOLOGICAL SCIENCE,
British Geological Survey, Wallingford (England).
For primary bibliographic entry see Field 2F.
W86-03563

6B. Evaluation Process

WATER 2000, VOLUME IX: PLAN MANAGEMENT SUMMARY,
New Castle County Water Resources Agency, DE.
For primary bibliographic entry see Field 6A.
W86-03435

PLANNING APPROACH FOR IMPROVED MANAGEMENT OF ILLINOIS STREAMS FOR RECREATION AND CONSERVATION,
Illinois Dept. of Conservation, Springfield. Comprehensive Planning Section.
For primary bibliographic entry see Field 5G.
W86-03452

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

MINIMIZING COSTS BY GOOD FINANCIAL MANAGEMENT,
Synthetic Organic Chemical Manufacturers Association, Inc., Washington, DC.
S. Sacks.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-142174, Price codes: A03 in paper copy, A01 in microfiche. IN: Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment, March 25-27, 1980, Dallas, Texas. Robert S. Kerr Environmental Research Lab., Ada, OK, April 1981. p 24-30.

Descriptors: *Wastewater treatment, *Wastewater, *Waste treatment, Economic aspects, Financial feasibility, Financing, Taxes, Tax rates.

There are a number of Federal financial programs that can be used to minimize the cost of pollution control facilities. The Small Business Administration has an Economic Injury Loan Program for pollution control covering requirements for air, water, RCRA, and TSCA as well as other Federal regulations. The direct loans are currently being offered at 8 1/4% and may extend up to thirty years. An alternative, Pollution Control Revenue Bond Program guaranteed by the Small Business Administration can save a company roughly 25% of their financing costs over a period of 25 years over conventional financing plans. The bonds are tax-exempt and guaranteed by the full faith and credit of the U.S. Government. The program is open to the smaller companies that are at a competitive disadvantage with the larger companies. The bond program should be considered for companies seeking sums over $150,000. Companies may also take advantage of tax incentives and tax credits such as the rapid tax amortization program and the Tax Reform Act of 1978. (Author)
W86-03886

6D. Water Demand

VIABILITY OF INTERBASIN, INTERSTATE/INTERNATIONAL TRANSFERS OF WATER,
Colorado State Univ., Fort Collins.
H. P. Caulfield.
Paper presented at Symposium on Rivers and River Management, July 10, 1984. 15 p, 9 ref.

Descriptors: *Water transfer, *Interbasin transfers, Agriculture, Future planning, Water supply, Foods, Fiber crops, Alternative water use, Drought, Carbon dioxide, Atmosphere, China.

Some take for granted that major interbasin, interstate, and international water transfer are inevitable and that they are now viable or soon will be. The thesis of this paper is: If no shortage of food and fiber is present or foreseen and if water has already been fully appropriated for beneficial uses, then future municipal and industrial needs can be met most efficiently in arid and semi-arid areas by transfers of water out of agricultural use. Thus no large-scale interbasin, international, or interstate transfers of water are justifiable. On the other hand if a fundamental shortage of food and fiber is present or foreseen and if water has already been fully appropriated for beneficial use, then large-scale interbasin, interstate, or international transfers might be justifiable. The author concludes: (a) the United States should not consider any such major transfers; (b) the Peoples Republic of China should pursue its present planning and consideration of interbasin, interprovincial water transfers. The logic of these opposite answers related to the abundance of food and fiber that promises to be available to the U.S. and inadequate supplies that China appears to face. Two implications for adequacy of water supply should be studied: (1) the probabilities of sustained/severe droughts, their probable effects, and strategies for coping with them; and (2) the build-up of CO2 in the atmosphere, causing temperature to rise and precipitation to fall. (Fazio-Omniplan)
W86-03436

TEXAS MANUFACTURING WATER USE: LONG-TERM PROJECTIONS,
Texas Dept. of Water Resources, Austin.
M. L. Wright, and F. G. Bloodworth.
LP-193, November 1983. 113 p, 13 fig, 17 tab, 24 ref, 1 append.

Descriptors: *Industrial water, *Texas, *Water use, *Projections, *Long-term planning, Economic production, Growth rates, Statistical models, Food processing industry, Pulp and paper industry, Chemical industry, Oil industry, Metals.

The Texas Department of Water Resources is required by law to project water requirements in the State for a 50-year period. Forecasted demands upon water resources are categorized according to purpose of use. The report concentrates upon the five largest water-using industries: chemicals, petroleum, paper and pulp, metals, and food processing. The growth in industrial water use is projected to double by the year 2015 and almost triple by 2030. Chemicals production will require most (59%) of the manufacturing volume throughtout the period, an increase of 692,000 acre-feet of annual use. Total water use in Texas for manufacturing is forecasted to grow from 1.5 million acre-feet in 1980 to 4.4 million acre-feet by 2030. The Department made the projections described in the report by several methods. The key feature was consultation with industry representatives, which produced valuable information about the anticipated future of each major water-using industry. All available long-term forecasts of industry growth were studied. The Department projected growth statistically. Probable economic events, such as a slowdown in production of primary metals and fuels, were included in the final determination of future changes in industry outputs. (Fazio-Omniplan)
W86-03441

WATER 2000, VOLUME V: WATER SUPPLY FACILITY OPTIMIZATION IN NORTHERN NEW CASTLE COUNTY.
New Castle County Water Resources Agency, DE.
For primary bibliographic entry see Field 5F.
W86-03443

WATER 2000, VOLUME VI: FORECAST OF FUTURE WATER DEMAND IN NEW CASTLE COUNTY.
New Castle County Water Resources Agency, DE.
October 1983. 74 p, 10 fig, 56 tab, 22 ref.

Descriptors: *Water demand, *Water requirements, *Potential water supply, *Water distribution, *Water management, Planning, Population dynamics, Water districts, Employment, Data acquisition, Peak demand.

This report forecasts water demand to the year 2010; these data can be used to determine if existing facilities can meet future demands and to identify the types and sizes of any new facilities needed. Water demand projections are shown for residential, commercial, industrial, institutional, irrigation and unaccounted categories. The latter includes inaccurate meters, leakage, hydrants, backwash and unauthorized uses. The projections have been separated by water use category and by utility to account for differences in demand among sectors and geographic areas. Total water use for both public and self-supplied water will exceed 91 mgd by the year 2010, up 18%, from 78 mgd in 1978. The commercial category is expected to increase the most, 9.4 mgd in 1978 to 14.12 mgd in 2010. Water use in this category was projected from employment forecasts, sales forecasts and related data. Increases in employment are expected to be modest, however, there may be significant shifts from one industry to another, e.g., nondurable goods to sevices, which would create a higher rate of water use per employee. For the county as a whole, residential water use is the second largest projected increase a 3.37 mgd increase to a level of 32.48 mgd in 2010. However, residential use will create the largest demand for the individual water utilities, with the exception of the City of Wilmington. These forecasts will help determine the amount of water needed and where the demand will be located. (Atkins-Omniplan)
W86-03444

WATER 2000: CONSERVATION PROGRAM.
New Castle County Water Resources Agency, DE.
For primary bibliographic entry see Field 3D.
W86-03445

DROUGHT-RELATED IMPACTS ON MUNICIPAL AND MAJOR SELF-SUPPLIED INDUSTRIAL WATER WITHDRAWALS IN TENNESSEE, (PART A AND PART B),
Geological Survey, Nashville, TN. Water Resources Div.
F. M. Alexander, L. A. Keck, L. G. Conn, and S. J. Wentz.
Available from OFSS, USGS, Box 25425, Lakewood, Co 80225. USGS Water-Resources Investigation Report 84-4074, 1984. 414 p, 47 fig, 55 tab, 44 ref.

Descriptors: *Water use, Water users, Available water, Surface water, Groundwater, Wells, *Drought effects, Aquifers, *Industrial water, *Tennessee.

A state-wide water use survey was conducted of all public water suppliers and large, self-supplied industries in Tennessee. This report contains a summation of the data received from 463 public-water suppliers and 129 self-supplied water users. Analysis of the study results and findings indicate that many communities in Tennessee do experience occasional water supply, quantity-related shortages. A total of 142 problems were reported by 107 of the public water suppliers. However, only 22 of the problems were a result of inadequate source supply. Although only three industries reported a water shortage problem, 20 were identified as having a potential water-supply source problem. West Tennessee was the only section of the state where all communities and industries surveyed reported an adequate water supply. The effects of a drought on the environment--specifically, wetlands, fish wildlife, and recreational-users--are briefly described, although there was no evidence that water withdrawn by communities or industry would directly affect the environment. This study appears to verify the conclusions that an extended drought, although directly affecting the supply to some communities and industries, may actually affect water quality and wastewater treatment more accurately by decreasing the ability of the source to assimilate wastes. (USGS)
W86-03560

CHALLENGES IN AFRICAN HYDROLOGY AND WATER RESOURCES: PROCEEDINGS OF THE HARARE SYMPOSIUM,
Ministry of Water Development, Salisbury (Zimbabwe).
For primary bibliographic entry see Field 2F.
W86-03562

APPLIED CLIMATOLOGY.
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Geographisches Inst.
For primary bibliographic entry see Field 2B.
W86-03846

6E. Water Law and Institutions

VIABILITY OF INTERBASIN, INTERSTATE/INTERNATIONAL TRANSFERS OF WATER,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 6D.
W86-03436

HUMAN ADAPTATION ALONG THE COLUMBIA RIVER 4700-1600 BP.: A REPORT OF TEST EXCAVATION AT RIVER MILE 590, NORTH CENTRAL WASHINGTON,
Central Washington Univ., Ellensburg.
J. C. Chatters, G. C. Cleveland, and D. E. Semko.
Central Washington University Occasional Paper, No 1, Research Report 84-1, January 1984. 135 p, 24 fig, 24 tab, 11 plates, 56 ref, 9 append. DACW67-82-C-0062.

Descriptors: *Environmental effects, *Rivers, *Archeology, Columbia River, Indians, Washington, Rufus Woods Lake.

Test excavations were conducted at Columbia River Mile 590 near Belevedere, Washington, to assess archeological sites which could be impacted by a 10-ft rise in Rufus Woods Lake. Four time periods were identified: I, over 4700 years ago; II, 4700-3500 years ago; III, 3500-2500 years ago; and IV, 3500-1600 years ago. The oldest known house structure, dating to 5300 years ago, in the state of Washington was discovered at the site. This was oval, unlike the round or square houses commonly found. In Period II the climate was warm, and the river flooded frequently. Pithouses were built on high terraces, except for field camps. As the river continued to aggrade, houses were built on the more stable flood plain as well as on high terraces. Hunting camps appeared at all locations. Erosion began about 2500 years ago with flash floods cutting away the flood plain and causing occupation sites for this period to be on higher ground. Settlement in all periods occurred near intermittent streams or no streams at all and changed with the nature of the river. (Cassar-PTT)
W86-03460

JOINT HYDROGEOLOGICAL SURVEYS,
GRW Engineers, Lexington, KY.
G. F. J. Jeurissen, and G. P. Kruseman.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 211-219, 1 fig, 2 tab.

Descriptors: *Water policy, Geohydrology, *Surveys, *Water resources development, *Research facilities, *Institutional constraints, Africa, Exploration, Geological surveys, International agreements, Monitoring, Wells, Hydrology.

Many African countries are in need of hydrogeological investigations as a basis for the rational development of their groundwater resources. They lack the necessary research institutes, however, because of the low priority given to groundwater investigations in the past. Experience has shown that at the national level the constraints to the rational development and management of the water resources are: the lack of a well defined water policy, lack of coordination, and conflicting interests between different institutions. At the institutional level the constraints arise from weak management and the lack of qualified personnel. The research institutes can be strengthened through cooperation programs with sister institutes from countries that have well developed groundwater survey institutes. Such programs should aim at training national personnel (on-the-job and through courses), during the joint execution of hydrogeological investigations and water resources assessment projects. Education institutions and other organizations responsible for water exploitation should be strengthened in a similar way. (Author)
W86-03579

HYDROGEOLOGICAL DATA COLLECTION, STORAGE, RETRIEVAL AND WATER LAW IN BOTSWANA,
Botswana Geological Survey, Lobatse.
For primary bibliographic entry see Field 7C.
W86-03580

LEGAL ENVIRONMENT OF A CONTAINMENT SITE: LAWS GOVERNING THE ACQUISITION, MAINTENANCE, AND OPERATION OF DREDGED MATERIAL DISPOSAL SITES,
Army Engineer District, Galveston, TX.
R. Harrison.
In: Aquaculture in Dredged Material Containment Areas: Proceedings September 1982, Galveston, TX. Miscellaneous Paper D-83-2, October 1983. p 191-196.

Descriptors: *Legal aspects, *Dredging, *Aquaculture, *Ponds, *Water law, Real estate, Easements, Leases, Property rights.

Prospective aquaculturists should be aware of the legal instruments governing the ownership and use of containment areas. The Corps of Engineers (CE) does not usually own disposal property, it only holds the easement to dispose of dredged material on the property. State real estate law governs the rights and the relationships pertaining to the property. Disposal easements grant the holder (the CE) all necessary and incidental rights to enjoy the easement, including construction and maintenance of levees, water control structures, etc. These do not have to be specifically identified in the easement instrument. The owner reserves all other rights. Activities by the owner or any leasor may not interfere with the easement holder in enjoying his easement rights, i.e., they may not interfere with the CE's disposal activities. Clearly, as a first step, the leasor or prospective culturist must deal with both the owner, to lease the right to use the property for aquculture, and with the CE, to obtain a consent document for this activity. Only with these two agreements in hand can any other activity proceed. (Author)
W86-03715

LEGAL IMPLICATIONS OF COASTAL EROSION IN LOUISIANA,
Louisiana State Univ., Baton Rouge. Sea Grant Legal Program.
P. Hribernick, and M. Wascom.
IN: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, October 5-7, 1981, Baton Rouge, Louisiana. FWS/OBS-82/59, September 1982. p 128-139, 50 ref.

Descriptors: *Wetlands, *Erosion, *Legal aspects, *Louisiana, Marshes, Coastal marshes, Environmental effects, State jurisdiction, Mineral resources, Resource management.

Erosion in the coastal zone of Louisiana has serious legal consequences for all property owners--private, State, and Federal. When a private property owner and the State are placed in an adversarial position, the general rule of Louisiana law dictates that erosion works against the private property owner's interest and works in favor of the State's interest. When the State and Federal Government are placed in an adversarial position, the general rule of law dictates that erosion works against the State's interest and works in favor of the Federal Government's interest. Following these general rules, if the forces of nature work to erode a private property owner's land, he may lose title of that land which erodes, and is valuable mineral resources, to the State. Similarly, if the forces of nature work to erode the coastline of Louisiana, the State may lose to the Federal Government, title to land in the Outer Continental Shelf in an amount corresponding to the number of acres of coastline that has eroded. At stake are invaluable mineral resources which pass with the ownership of the land. (Author)
W86-03860

ECONOMIC AND CULTURAL CONSEQUENCES OF LAND LOSS IN LOUISIANA,
Nicholls State Univ., Thibodaux, LA. Dept. of Earth Science.
For primary bibliographic entry see Field 6G.
W86-03861

6F. Nonstructural Alternatives

LEVEE POLICY FOR THE NATIONAL FLOOD INSURANCE PROGRAM,
National Research Council, Washington, DC. Committee on a Levee Policy for the National Flood Insurance Program.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-134619, Price codes: A06 in paper copy, A01 in microfiche. National Academy Press, Washington, DC. 1982. 107 p, 5 fig, 3 tab, 6 app.

Descriptors: *Levees, *Insurance, *Flood damage, *Flood plain management, *Flood control, *Policy making, *Economic aspects, Disasters, Local governments, Hazards, Inspection, Maintenance, Regulation, Flood protection, Flood plain zoning, Earthworks, Embankments, Mapping, National Flood Insurance Program, Flood insurance rate maps, Risks, Floodways.

This report formulates principles for a levee policy to help make decisions regarding flood insurance rates, land occupancy regulation, flood insurance puchase requirements, siting of critical facilities, notification of flood hazard, and warning/evacuation programs. Recommendations are mainly directed to levees along rivers with conditions that may threaten life, not to levees on smaller streams. Levees fulfilling certain conditions of construction, inspection, and operation and maintenance are recognized as reducing risks of flood damage. The community's responsibilities in floodplain development and levee management are also specified. For example, existing levees providing protection against 25-year floods and new levees providing protection against 100-year floods generally reduce flood damage. However, each levee is evaluated individually. Guidelines are given for rating procedures and mapping flood plains.
W86-03622

6G. Ecologic Impact Of Water Development

DISTRIBUTION AND RELATIVE ABUNDANCE OF FISHES IN WISCONSIN; V: GRANT AND PLATTE, COON AND BAD AXE, AND LACROSSE RIVER BASINS,
Wisconsin Dept. of Natural Resources, Madison. D. Fago.
Technical Bulletin No 152, 1985. 112 p, 4 fig, 17 tab, 27 ref, 2 append.

Descriptors: *Baseline studies, *Fish populations, *Wisconsin, *River basins, *Surveys, Fish management, Natural resources, Species diversity, Water resources development, Data collections.

A statewide survey of the island waters of Wisconsin was initiated by the Bureau of Research, Wisconsin Department of Natural Resources to establish a comprehensive data base on the distribution and relative abundance of all fish species, including nongame species. The Grant and Platte, and Coon and Bad Axe, and La Crosse River basins were sampled from 1975 through 1982 by personnel from research at 327 stations, from fish management at 14 stations, and from U.S. Fish and Wildlife Service at 2 stations. An additional 124 stations were partially sampled by fish management personnel. A total of 74 species was collected from the Grant and Platte River basin, 63 from the Coon and Bad Axe River basin, and 60 from the La Crosse River basin. The endangered boldeye and the threatened Ozark minnow were included in the sampling. The weed shiner, pirate perch, and mud darter on the Department's watch list were also collected. Data from recent collections for the Grant and Platte, Coon and Bad Axe, and La Crosse River basins were compared to those from the 1900-28 and the 1950-74 periods. Twenty-four species which had not been previously reported were collected from the Grant and Platte River basin, 14 from the Coon and Bad Axe River basin, and 23 from the La Crosse River basin. Four species have apparently been extirpated from the Grant and Platte River basin, 14 from the Coon and Bad Axe River basin, and 4 from the La Crosse River basin. (Geiger-PTT)
W86-03501

INFLUENCE OF CHANNEL REGULATING STRUCTURES ON FISH AND WILDLIFE HABITAT: APPENDIX - VOLUME I, FIGURES AND PHOTOGRAPHS.
Missouri Univ.-Rolla. Inst. of River Studies.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-121582, Price codes: A12 in paper copy, A01 in microfiche. August 1982. 259 p, 228 fig, 70 photos. DACW43-81-C-0061.

Descriptors: *Channel improvements, *Navigation, Channel morphology, Dikes, Earthworks, Spur dikes, Dams, Embankments, Dam effects, Environmental effects.

This appendix contains the following list of illustrations: plan view of study area; study area tracings; dike histories; discharge hydrograph (1981) data collection periods; plan and range lines; contour lines; dike profiles; velocity profiles; gradation curves; examples of bed and water area calculations; an artificial substrate sampler; location of water quality and grab (dredge) sampling sites; river stages at Chester, Illinois, in 1981; the effect of river stage on gear efficiency; and various photographs, both aerial and land, showing dikes used within the study area. The report to which this volume is appended, evaluates aquatic habitat diversity, and various other physical characteristics in the vicinity of channel regulating structures, and recommends data needs and structural modifications to protect fish and wildlife and maintain an acceptable navigating channel. (Halterman-PTT)
W86-03509

IMPOUNDED RIVERS: PERSPECTIVES FOR ECOLOGICAL MANAGEMENT,
Loughborough Univ. of Technology (England). Dept. of Geography.
G. E. Petts.
John Wiley and Sons, Chichester, England, 1984. 326 p.

Descriptors: *Rivers, *Reservoirs, *Dam effects, *Ecological effects, *Environmental effects, Reservoir operation, Fisheries, Dams, Environmental impact statement, Water resources development, Channel morphology, Macroinvertebrates, Dam construction, River basins, Water quality, Plankton, Fish.

The book presents a geographical analysis of impounded rivers. It seeks to generate an improved awareness of the fate of rivers, and of the scale of change in space and time after dam construction. The focus is placed initially on the physical and chemical alterations to river systems imposed by impoundment, and then on the implications of these alterations for the biological components. The first chapter describes the global distribution of impounded rivers, the history of related scientific inquiry, and the spatial variability of natural river systems, leading to a preliminary appraisal of the different effects of impoundment. Chapter two considers the primary effects of impoundment upon hydrological characteristics, while chapter three examines the impacts on water quality. Chapter four studies the effects of river impoundment on the mineral and plankton components of seston transport. The effects of these primary impacts upon channel morphology is examined in chapter five. In chapter six, aquatic, riparian, and floodplain vegetation changes are discussed. The effects of these changes on the benthic macroinvertebrates and on fish and fisheries are discussed in chapters seven and eight, respectively. In chapter nine, the environmental considerations that are most pertinent to successful river management are discussed, namely the problems of forecasting ecological change prior to impoundment, and the potential effectiveness of responsive approaches. (Geiger-PTT)
W86-03516

DIRTY DEVIL PROJECT: CLASS II CULTRAL RESOURCES INVENTORY IN CENTRAL UTAH,
P-III Associates, Inc., Salt Lake City, UT.
B. L. Tipps, and K. W. Russell.
Cultural Resources Report 8402-1-8406, 1984. Cultral Resources Program: Bureau of Reclamaton. 45 p, 8 fig, 6 tab, 73 ref, 1 append.

Descriptors: *Land use, *Cultural resources inventory, *Planning, *Water quality control, *Salt ponds, Salinity, Saline water intrusion, Saline water, Water quality management, Ecological effects, Ponds, Topology, Intermittent streams.

The report documents the results of a Class II cultural resource inventory conducted for the Bureau of Reclamation in central Utah. The work was required to collect data on cultural resources prior to the construction of salinity ponds along several intermittent drainages near Hanksville and Emery, Utah. The work was part of the Dirty Devil Salinity Project, an endeavor designed to reduce salt flow into Muddy Creek and the Dirty Devil River through the construction of the salinity ponds. The inventory was necessary to assist the Bureau of Reclamation in fulfilling their legal obligations and environmental planning responsibilities concerning cultural resources. A pedestrian survey of approximately 650 acres resulted in the discovery and documentation of six prehistoric sites within the study area. Although the sites vary in size and density, all of the sites can be characterized as lithic scatters or lithic source area. Due to a lack of diagnostic artifacts and/or features, none of the sites could be identified according to cultural affiliation or chronological placement. None of the sites are considered potentially eligible to be recorded in the National Register. (Geiger-PTT)
W86-03518

FINAL ENVIRONMENTAL IMPACT STATEMENT: REGIONAL FLOOD CONTROL TONAWANDA CREEK, GENESEE COUNTY, NEW YORK,
Corps of Engineers, Buffalo, NY. Buffalo District.
For primary bibliographic entry see Field 4A.
W86-03626

IMPACTS OF FLOODING REGIME MODIFICATION ON WILDLIFE HABITATS OF BOTTOMLAND HARDWOOD FORESTS IN THE LOWER MISSISSIPPI VALLEY,

Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
C. V. Klimas, C. O. Martin, and J. W. Teaford.
Technical Report EL-81-13, October 1981. Final Report. 200 p, 15 tab, 300 ref, append.

Descriptors: *Flood plain management, *Floods, *Forests, *Wildlife habitats, Hardwood, Aquatic animals, Literature review, Logging, Land clearing, Mississippi River.

This is a literature review concerning the impacts of flooding regime modification on bottomland hardwood forest wildlife habitats of the lower Mississippi Valley. The composition and structure of the bottomland forest are an important determinant of the quality and type of wildlife habitat available. These forest characteristics are largely influenced by the flooding regime. Overstory diversity and perennial understory diversity and productivity are lowest in near-permanently flooded habitats and increase in areas flooded less frequently and for shorter periods of time. Nonflooded areas are often, but not always, less diverse and productive than infrequently flooded areas. Tree growth, regional habitat diversity, and land clearance patterns may also be influenced by modifications to the hydrologic regime. Bottomland forests are considered productive wildlife habitat due to high soil fertility, abundant moisture, and the diversity and abundance of wildlife food and cover. Modifications in the magnitude, frequency, and duration of flooding are expected to bring about a wide variety of impacts on different species. Impacts of flooding regime modifications are discussed for mammals, birds, reptiles, and amphibians. Aquatic and semiaquatic species are generally adversely affected by flood reduction and are benefitted by normal flooding conditions. Species that are principally terrestrial may be severely impacted by major flooding events, but they may respond more to secondary influences such as land clearing and logging. Where known, both direct and indirect impacts of flooding regime modifications are discussed by species or species groups occurring in the study area.
W86-03634

EFFECTS OF FLUCTUATING RESERVOIR WATER LEVELS ON FISHERIES, WILDLIFE, AND VEGETATION: SUMMARY OF A WORKSHOP, 24-26 FEBRUARY 1981,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
Miscellaneous Paper E-83-2, U.S. Army Environmental and Water Quality Operational Studies, July 1983, Final Report. Edited by Hollis H. Allen and Larry R. Aggus. 55 p.

Descriptors: *Environmental effects, *Habitats, *Wildlife, *Vegetation, *Fish management, *Reservoir operation, *Water level fluctuations, Fluctuations, Drawdown, Shoreline cover, Multipurpose reservoirs, Aquatic habitats, Lakes, Aquatic plants, Waterfowl, Wetlands, Planting management, Water management.

A workshop on the environmental effects of fluctuating water levels in reservoirs concerned three general topics: vegetation, wildlife, and fisheries. Abstracts of principal papers and a summary for each topic are presented. Adverse effects of shorelines denuded of vegetation are loss of food and habitat for animals, increased erosion and turbidity, leaching of soils, and loss of nutrients from decomposing organic matter. Some promising methods for evaluating effective shoreline revegetation are described. A simple screening method for perennial plant species uses a survey of the literature and of the local plant community, field and laboratory investigations of candidate plants, and recommendations for large-scale plantings. Only a small fraction of potentially useful plants has been tested thus far. Wildlife concerns are closely related to vegetation conditions. Reservoirs should be managed on an individual basis. Many reservoirs can be managed on a subimpoundment level, taking advantage of existing conditons to increase habitat quality. Good fisheries management often conflicts with reservoir operation. Although management strategies for reservoirs are highly individual, some general principles were noted. Water levels are raised in spring to promote spawning and lowered in summer to permit regrowth of vegetation. Fall and winter drawdown is often used to control aquatic vegetation and concentrate prey species. Drastic and prolonged drawdown for revegetation and later restocking of fish is effective but often conflicts with reservoir operation. In coldwater reservoirs, management policies usually favor salmonids over vegetation.
W86-03642

POTENTIAL BIOLOGICAL IMPACTS OF NAVIGATION TRAFFIC,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
T. D. Wright.
Miscellaneous Paper E-82-2, U.S. Army Environmental and Water Quality Operational Studies, June 1982. Final Report. 25 p, 28 ref.

Descriptors: *Navigation, *Aquatic life, *Environmental effects, *Water pollution sources, *Sedimentation, *Transportation, Literature review, Ships, Turbulent flow, Aquatic animals, Aquatic environment, Suspended solids, Propellers, Waves, Water current, Aquatic insects, Insects, Drawdown, Dissolved oxygen, Oxygen, Particulate matter, Nutrients, Fate of pollutants, Oil spills, Chemicals.

A literature search was conducted to identify research relating physical and chemical changes associated with navigation traffic potential biological impacts. It was found that, although some information on physical and chemical changes was available, documentation to demonstrate biological impacts was generally lacking. Where possible impacts were identified, they were observed at the organism level, rather than population, community, or ecosystem level. A particular problem was encountered in attempting to separate impacts of navigation from those caused by natural and/or anthropogenic perturbations. It was concluded that biological impact analysis beyond the organism level may not be within existing state-of-the-art technology. (Author)
W86-03645

CONTAMINANTS IN THE UPPER MISSISSIPPI RIVER: PROCEEDINGS OF THE 15TH ANNUAL MEETING OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM.
Butterworth, Boston. 1984. Edited by James G. Weiner, Richard V. Anderson, and David R. McConville. 368 p.

Descriptors: *Environmental effects, *Fate of pollutants, Rivers, *Sediments, *Erosion, *Channeling, *Aquatic habitats, Aquatic animals, Backwater, Metals, Wildlife, Water quality, Planning, *Mississippi River.

Concerns for the future of the Upper Mississippi River were presented at a meeting featuring synthesis and original research papers. The ecological history of this section of the river emphasized the effects of channel improvement, starting with rudimentary works in 1824 and continuing with construction of locks and dams to form a series of navigation pools. The degraded Illinois River was described as a possible fate of the Upper Mississippi. Sedimentation studies showed the origin and transport of sediments and that many backwater lakes are likely to become marshes within 50-100 years. Analysis of trace substances in water, wildlife, plants, and sediments indicated that levels of several metals, including cadmium, mercury, and lead, were high in certain sections, namely Lake Pepin, Fountain City Bay, and other pools downstream of the Twin Cities region. Concentrations of polychlorinated biphenyls and organochlorine pesticides in sediments and waterfowl eggs were documented. Monthly water chemistry monitoring of 12 common parameters showed that most variations were related to river discharge rates. A mathematical model was used to predict impacts of navigation on the river for the near future and for the years 2000 and 2040.
W86-03737

ECOLOGICAL HISTORY OF THE UPPER MISSISSIPPI RIVER,
Winona State Univ., MN.
C. R. Fremling, and T. O. Claflin.
In: Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium, Butterworth, Boston. 1984. p 5-24, 7 fig, 22 ref.

Descriptors: *Environmental effects, *Ecological effects, Rivers, *Aquatic habitats, *Channel improvement, *Navigation, History, Mississippi River, Aquatic life, Fish, Wetlands, Sedimentation, Invertebrates, Sediment transport, Erosion, Dams, Locks, Rivers and Harbors Act, Marshes, Water pollution sources.

The Upper Mississippi Valley, opened to Caucasians by Joliet's explorations in 1673, was the site of rapid population growth and trading during the 1700's. This section of the river was surveyed in the early 19th century. The beginning of steamboat travel in 1823 led to navigation improvements by the Army Corps of Engineers starting in 1824. Settlements continued to grow in number and population, stimulating cutting of forests for lumber and agricultural activities, particularly steepland farming. These practices contributed to erosion and degradation of the river system. The Rivers and Harbors Acts of 1878, 1890, and 1907 resulted in channel deepening and other construction works in the section from Minneapolis to the Ohio River. These works used wing and closing dams, shore protection, and auxiliary dredging, permitting open-channel navigation. By 1870 the fisheries were rapidly declining as a result of wide fluctuations in water level which stranded fish in backwaters. Fish rescue operations were begun in 1879 and continued until the 1950's in a few locations. In the 1930's more extensive channelization projects started. The channel was deepened to 9 ft by construction of locks and dams (29 built during this period), supplemented by dredging. As a result of the impoundments, the river habitat has changed, vastly increasing the marsh area and slack water area habitat available for invertebrates, periphyton, fish (139 species), furbearers, and waterfowl. Some long-term detrimental changes caused by the channel modifications include accelerated sedimentation (changing wetlands into floodplains), eutrophication, and accumulation of industrial wastes.
W86-03738

ROLE OF CONTAMINANTS IN THE DECLINE OF THE ILLINOIS RIVER: IMPLICATIONS FOR THE UPPER MISSISSIPPI,
Illinois Natural History Survey, Champaign.
R. E. Sparks.
In: Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium, Butterworth, Boston. 1984. p 25-66, 17 fig, 103 ref.

Descriptors: *Environmental effects, *Water pollution effects, *Ecological effects, Rivers, *Aquatic habitats, *Channel improvement, *Navigation, Mississippi River, Aquatic life, Fish, Wetlands, Sedimentation, Invertebrates, Sediment transport, Erosion, Agricultural watersheds, Marshes, Water pollution sources, Illinois River, Vegetation, Aquatic plants, Lakes, Water quality, Waterfowl, Clams, Ducks.

The Illinois River, similar in geologic origin, history, and stream biota to the Upper Mississippi River, has suffered ecological changes from human activities since 1870. The river channel has been deepened in the center. Fingernail clams, snails, naiads, caddisflies, largemouth bass, mayflies, and other aquatic species have disappeared or diminished significantly. Water levels and sediment transport have increased. Sediments are suspended and relocated by boat traffic. Quiver Lake, adjoining the river, has changed from a clear lake with aquatic vegetation and an abundance of macroinvertebrates to a sediment-filled basin, rapidly turning into a willow-cottonwood forest. Nearby Thompson Lake, which contained abundant fish, waterfowl, and muskrats in the 1870's was drained and turned into farmland. The Upper Mississippi is

less susceptible to changes of this type because it is larger and land use more favorable (more orchards, hay, and pastures and less plowed land). Nevertheless, during drought, warning signs appear in the Mississippi, namely high ammonia levels, low dissolved oxygen levels, decline in fingernail clams. A study of the Upper Mississippi may help prevent the irreversible changes that have occurred in the Illinois River.
W86-03739

SEDIMENTS OF THE UPPER MISSISSIPPI RIVER: THEIR SOURCES, DISTRIBUTION, AND CHARACTERISTICS,
Winona State Univ., MN.
For primary bibliographic entry see Field 2J.
W86-03740

RECENT RATES OF SEDIMENTATION IN THE MISSISSIPPI RIVER,
Agricultural Research Service, Durant, OK. Water Quality and Watershed Research Lab.
For primary bibliographic entry see Field 2J.
W86-03741

INVESTIGATION OF EFFECTS OF NAVIGATION TRAFFIC ACTIVITIES ON HYDROLOGIC, HYDRAULIC, AND GEOMORPHIC CHARACTERISTICS IN THE UPPER MISSISSIPPI RIVER SYSTEM,
Simons, Li and Associates, Inc., Fort Collins, CO.
For primary bibliographic entry see Field 5B.
W86-03750

CONTAMINANTS IN THE UPPER MISSISSIPPI RIVER: SUMMARY AND CONCLUSIONS,
Geological Survey, Menlo Park, CA.
S. N. Luoma.
In: Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium, Butterworth, Boston. 1984. p 345-356, 23 ref.

Descriptors: *Environmental effects, *Fate of pollutants, *Aquatic habitats, Rivers, *Channeling, Sediments, Erosion, Locks, Dams, Navigation, Water quality, Ecological effects, Aquatic animals, Wildlife.

Within an ecologically relevant temporal context (more than 100 years) the Upper Mississippi can be viewed as a system responding to perturbations that drastically changed the direction of natural successional trends between 1900 and 1930. The system appears to be moving rapidly toward the ecological simplification that so often characterizes human perturbation: fewer waterfowl, less benthic diversity, and poorer fisheries. Such a fate would be less likely in an unchanneled, free-flowing river. Superimposed on the trends initiated by physical modification is an input of toxic and organic wastes, which the system will be increasingly less able to assimilate as succession proceeds, and which have played some detectable role in biological simplification of at least one major tributary. The present trend of change in the Upper Mississippi was established 50 to 75 years ago when the river was channelized and the locks and dams were constructed. Better waste treatment, less use of toxins in the watershed, and more soil conservation could slow the trend toward ecological simplification. The need for these expensive mitigating measures is much greater today than if the system had not been modified physically. The ultimate fate of the river is now a function of its new identity, which includes a series of partial impoundments. The major question is how to slow or reverse succession in these input-sensitive impoundments. If possible at all, this will only occur if humans assume responsibility for the assimilative functions once provided by the free-flowing river. (Author)
W86-03752

WYCOAL GAS COAL-GASIFICATION PROJECT; PRELIMINARY DRAFT ENVIRONMENTAL IMPACT STATEMENT, VOLUME 2,
Woodward-Clyde Consultants, San Francisco, CA.
For primary bibliographic entry see Field 5G.
W86-03840

PROCEEDINGS: 2ND ANNUAL GULF OF MEXICO INFORMATION TRANSFER MEETING.
Minerals Management Service, Metairie, LA. Gulf of Mexico OCS Regional Office.
For primary bibliographic entry see Field 10D.
W86-03841

PROCEEDINGS OF THE CONFERENCE ON COASTAL EROSION AND WETLAND MODIFICATION IN LOUISIANA: CAUSES, CONSEQUENCES, AND OPTIONS.
Louisiana Universities Marine Consortium, Chauvin.
For primary bibliographic entry see Field 2J.
W86-03850

WETLAND LOSS DIRECTLY ASSOCIATED WITH CANAL DREDGING IN THE LOUISIANA COASTAL ZONE,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
W. B. Johnson, and J. G. Gosselink.
IN: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, October 5-7, 1981, Baton Rouge, Louisiana. FWS/OBS-82/59, September 1982. p 60-72, 5 fig, 6 tab, 15 ref.

Descriptors: *Wetlands, *Canals, *Dredging, *Marshes, *Louisiana, Canal construction, Inland waterways, Banks, Erosion, *Bank erosion.

Wetland losses resulting from canals, including initial construction practices and subsequent canal bank erosion, are discussed. Results of field measurements indicated that the average width of newly dredged canals exceeded the permit specifications by 13.4 m. The total width affected, including berm and spoil deposits, exceeded the permit specifications by an average of 81.7 m. Continued widening due to erosion, as illustrated by several case histories, is discussed. Canals in areas of greatest boat activity widened at a rate of 2.58 m/yr, while those in areas of minimal boat activity widened at a rate of 0.95 m/yr. (Halterman-PTT)
W86-03854

CANALS AND WETLAND EROSION RATES IN COASTAL LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
R. E. Turner, R. Costanza, and W. Scaife.
IN: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, October 5-7, 1981, Baton Rouge, Louisiana. FWS/OBS-82/59, September 1982. p 73-84, 7 fig, 2 tab, 15 ref.

Descriptors: *Wetlands, *Canals, *Dredging, *Marshes, *Louisiana, Canal construction, Inland waterways, Banks, Erosion, *Bank erosion.

Canals have increased in area from practically zero at the beginning of the century to about 2.4% of the Louisiana coastal surface area in 1978. The annual increase in canal area is continuing to climb in 1981 as a result of new canal dredging and the widening of existing canals. Land loss rates across the coastal zone since the 1890's, among hydrologic units, and within areas of similar substrates and equal distances to the coast, are all positively related to estimates of canal density. Further, estimates of land loss at zero canal density (from regression equations) are similar to the 7,000 year coast-wide rate of gain in land. Within 7 1/2' quadrangle maps, the new 'holes' or ponds in the marsh have appeared close to canals, not near natural channels. Coastwide, canal surface is about 10% of the total land loss. Based on the analysis presented, it was concluded that coastal erosion rates in Louisiana are largely an indirect result of canal dredging activities or use. The mechanism for the effect probably involved an alteration in wetland hydrology, but a complete understanding is presently lacking. (Author)
W86-03855

EFFECT OF COASTAL ALTERATION ON MARSH PLANTS,
Louisiana State Univ., Baton Rouge. School of Forestry and Wildlife Management.
For primary bibliographic entry see Field 2L.
W86-03856

EFFECTS OF WETLAND DETERIORATION ON THE FISH AND WILDLIFE RESOURCES OF COASTAL LOUISIANA,
Fish and Wildlife Service, Lafayette, LA.
For primary bibliographic entry see Field 2L.
W86-03857

SOME CONSEQUENCES OF WETLAND MODIFICATION TO LOUISIANA'S FISHERIES,
Louisiana Dept. of Wildlife and Fisheries, Baton Rouge.
For primary bibliographic entry see Field 2L.
W86-03858

WETLAND LOSSES AND COASTAL FISHERIES: AN ENIGMATIC AND ECONOMICALLY SIGNIFICANT DEPENDENCY,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 2L.
W86-03859

ECONOMIC AND CULTURAL CONSEQUENCES OF LAND LOSS IN LOUISIANA,
Nicholls State Univ., Thibodaux, LA. Dept. of Earth Science.
D. W. Davis.
IN: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, October 5-7, 1981, Baton Rouge, Louisiana. FWS/OBS-82/59, September 1982. p 140-158, 50 ref.

Descriptors: *Wetlands, *Erosion, *Economic aspects, *Louisiana, Marshes, Coastal marshes, Environmental effects, Louisiana, Wildlife, Resource management, Fisheries.

Various aspects of the loss of lowland marshes along the coast of Louisiana are discussed. An important nursery ground and habitat for migratory waterfowl, fur and hide-bearing animals and fisheries will be lost. 'High' land, already scarce, will be at a premium and the cumulative economic effect is estimated to be in the billions of dollars. Loss of offshore oil royalties is estimated to be nearly $20 million for each mile of coastal retreat. The loss of unique lifestyles and cultural heritage is also discussed. (Halterman-PTT)
W86-03861

7. RESOURCES DATA

7A. Network Design

SOME CRITICAL ISSUES WITH MONITORING CRYSTALLINE ROCK AQUIFERS FOR GROUNDWATER MANAGEMENT IN RURAL AREAS,
Prakla-Seismos Geomechanik, Accra (Ghana).
For primary bibliographic entry see Field 2F.
W86-03567

APPRAISAL OF SEDIMENT TRANSPORT MEASUREMENT IN GHANAIAN RIVERS,
Water Resources Research Inst., Accra (Ghana).
S. A. Akrasi, and N. B. Ayibotele.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No 144, 1984. p 301-312, 5 fig, 4 tab, 20 ref.

Descriptors: *Network design, *Erosion, *Sediment transport, *Sediment yield, Data collections,

*Hydrologic data collections, Ghana, Volta River, Rivers, Bed load, Sedimentation.

A sediment monitoring network for Ghana is proposed. Existing data are used to establish a framework; the new system is designed to confirm doubtful data and fill in missing information. Thus, a less expensive network is possible. Current sedimentation problems involve construction of bridges over the Tano River, the effect of gold dredging on the Offin River, sedimentation around the intakes of several water supplies, and sedimentation in the Oti River. In the Volta drainage basin information needs include bed load movement, particle size distribution of the suspended load, the relationship between runoff and sediment discharge per unit area of land, and sediment discharges of several tributaries. In the southern and coastal drainage basins, more must be known about the suspended load, sediment transport at higher river discharges, and further measurements to confirm the station and regional rating curves.
W86-03586

EVALUATING CHANGES IN DIKE FIELD FISHES WITH COMMUNITY INFORMATION INDICES,
Oak Ridge National Lab., TN.
H. N. Polovino, M. P. Farrell, and C. H. Pennington.
Technical Report E-83-14, June 1983. Final Report. U. S. Army Environmental and Water Quality Studies, Army Engineer Waterways Experiment Station, Vicksburg, MS. 47 p, 21 fig, 6 tab, 46 ref.

Descriptors: *Network design, *Fish populations, *Sampling, *Dikes, *Aquatic habitats, *Species composition, *Environmental effects, Wildlife, Mississippi River, Ecological distribution, Habitats, Spatial distribution, Classification, Similarity coefficients, Water temperature, Temperature, Water level, Water management, Distribution patterns, Species diversity.

Researchers characterizing ecological communities are often faced with the problem of collasping large species lists into a single numeric expression of community structure. Historically, quantitative species diversity indices have been used to assess spatial and temporal changes in ecological communities. However, other classification estimates (e.g., binary similarity coefficients and quantitative dissimilarity measures) offer methodologies for delineating community composition that may be more sensitive to sampling error. This study evaluates the relative performance of (1) binary similarity coefficients; (2) dissceimilarity measures; and (3) diversity indices, calculated for three sampling methods, in detecting changes in fish communities associated with two dike fields on the Mississippi River. Dike field fish communities were sampled and evaluated for five hydrologic seasons, based on water temperature and flow velocities, and were found to be least similar during high-water low-temperature conditions. During the evaluation, the informaiton derived from electroshocking was the most representative when compared with hoop net and seine information. Of the three families of community information measures, binary similarity coefficients proved to be the most sensitive indicators of change in dike field fish communities. It was further found that measures based on species presence/absence represent a valid alternative method for characterizing change in community structure. This is especailly true when species abundance data are highly variable, which is the case in many fisheries assessments. (Author)
W86-03628

WATER QUALITY MONITORING: A SYSTEM'S PERSPECTIVE,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
R. C. Ward.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-119222, Price codes: A03 in paper copy, A01 in microfiche.
In: Nonpoint Nitrate Pollution of Municipal Water Supply Sources: Issues of Analysis and Control, Proceedings of an IIASA Task Force Meeting, February 10-12, 1982, Laxenburg, Austria. Series No. CP-82-S4, 1982. p 163-205, 1 fig, 65 ref.

Descriptors: *Monitoring, *Water quality, *Nonpoint pollution sources, *Sampling, *Water analysis, *Network design, Data acquisition.

Water quality monitoring is an effort to obtain information about the physical, chemical and biological characteristics of water via statistical sampling. The usefulness of the information is highly dependent upon a monitoring program, or system, being properly designed and operated. A monitoring system is defined as a sequence of operations; (1) sample collection; (2) laboratory analysis; (3) data handling; (4) data analysis; and (5) information utilization. The design of each component is discussed in the context of how it affects the overall usefulness of the resulting information. The data collection/utilization balance, a scientific understanding of water quality, data utilization strategies and network design documentation are specific aspects of monitoring where improvements can be made, thus greatly enhancing our ability to obtain useful information on water quality. With the system's perspective of monitoring and a discussion of specific areas for improvement, it is hoped that the important role water quality monitoring should play in enhancing management of water quality can be more readily visualized and that monitoring, with its better defined role, will ultimately provide a basis for a much more scientific understanding of water quality than that currently available. (Author)
W86-03655

CAN THE LINEAR BALANCE MODEL BE EXTENDED TO THE WHOLE ALPS,
Laboratoire de Glaciologie et Geophysique de l'Environnement, Grenoble (France).
For primary bibliographic entry see Field 2C.
W86-03697

PROBLEMS ON THE UPPER MISSISSIPPI RIVER AND ITS TRIBUTARIES: NEED FOR A LONG-TERM RESOURCE MONITORING PROGRAM,
Columbia National Fisheries Research Lab., La Crosse, WI. Field Research Station.
G. A. Jackson, C. E. Korschgen, P. A. Thiel, J. M. Besser, and D. W. Steffeck.
In: Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium, Butterworth, Boston. 1984. 325-343 p, 1 fig, 14 ref.

Descriptors: *Network design, *Planning, *Environmental effects, *Monitoring, *Aquatic habitats, Rivers, Mississippi River, Erosion, Sedimentology, Fate of pollutants, Wildlife, Great River Environmental Action Team, Recreation, Habitats.

A comprehensive long-term resource monitoring program has been proposed to mitigate adverse environmental effects of human activities in the Upper Mississippi River area. The program will provide a solid foundation of scientific data within a totally integrated framework so that managers will have information on which to base decisions. This involves both coordination with existing programs and standardization of methods to promote system-wide comparisons. The goal is to plan ahead rather than react to each threat to the environment. Major problems facing this section of the river are upland erosion and sedimentation of aquatic habitats, point and nonpoint source pollution, navigation-related activities, and habitat encroachment. Monitoring efforts should involve land use, meteorology, hydrology and sedimentology, water and sediment, contaminants, aquatic vegetation, amphibians, birds, fish, mammals, and recreation. Of the monitoring alternatives suggested, Level II is recommended. This includes comprehensive and completely integrated monitoring in selected pools, certain routine measurements throughout the entire system, and special studies at sites of particular importance to the entire system and site involved in mitigation, enhancement, or habitat rehabilitation.
W86-03751

DESIGN OF A HYDROCHEMICAL DATA COLLECTION PROGRAMME,
Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.
Y. Bachmat.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 153-165, 2 tab, 14 ref.

Descriptors: *Hydrologic data collections, *Data acquisition, *Data interpretation, *Decision making, *Network design, *Planning, *Economic aspects, *Resources management, Data collections, Management planning, Chemical properties, Design criteria.

Collection of hydrochemical data is considered in the context of producing data, which may be used for managing natural water resources and their interaction with the human-controlled environment. Imperfect data and/or misuse of information result in opportunity losses owing to suboptimal management desicions. The value of data is measured by their actual contribution to the reduction of risk associated with errors. This contribution can be increased by improving the utilization of existing data in the decision-making process and by the acquisition of new usable data. Both ways take time and require an investment of human and financial resources. An optimal data collection program is one which covers both the structural and non-structural aspects, is physically realizable and economically optimal in a space-time framework. The design of the program involves identifying information errors and quantifying their relationships to the associated losses and to the design parameters of the program. The problem of planning a hydrochemical data collection program is formulated and the hierarchical structure of the planning process is emphasized. Outlines of the feasibility study of the program and of the steps comprising the preliminary design of the observation network are given. The need to match the types of decisions to be made at the various phases of the planning process with the methods of arriving at the decisions is emphasized.
W86-03767

TEMPORAL CHANGES IN GROUND WATER QUALITY IN THE PHREATIC ZONE UTTAR PRADESH (INDIA) AND THEIR IMPACT ON SAMPLING SCHEDULE,
Central Chemical Lab., Lucknow (India).
For primary bibliographic entry see Field 2F.
W86-03768

RELIABILITY OF INFORMATION IN HYDROGEOCHEMICAL INVESTIGATIONS,
Akademiya Navuk BSSR, Minsk.
L. Babiy.
IN: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 179-185, 12 ref.

Descriptors: *Water sampling, *Geochemistry, *Hydrological data collections, *Data interpretation, *Errors, *Theoretical analysis, *Geohydrology, *Thermodynamics, Data collections, Hydrologic models, Statistical models, Statistical methods, Chemical properties.

The reliability of hydrogeochemical conclusions depends firstly on the quality of primary data. Errors in hydrochemistry are associated with the object of study (type of natural water and its location), the method of study (instruments and sample preparation) and by the quality of the investigation. The reliability of hydrogeochemical conclusions also depends on the methods of data interpretation used. Errors in interpreting statistical results occur when linear connections of a statistical model are identified with the natural situation. Investigations of stagnant waters should not be based on characterization by inorganic components alone since organic matter predominates in this type of water. Physical-chemical modelling, based on methods of equilibrium thermodynamics and allowing only for thermodynamic constants

for inorganic matter, provides only a qualitative characteristic of system development. The reliability of hydrogeochemical data is increased if silt, soil and pore waters are studied simultaneously with the various water types and if modern analytical methods of geophysical and other sciences are also applied.
W86-03769

CONDITIONS AND FREQUENCY OF SAMPLING FOR ELUCIDATIONS OF TRANSPORT MECHANISMS AND ELEMENT BUDGETS IN UPLAND DRAINAGE BASINS,
Aberdeen Univ. (Scotland). Dept. of Soil Science.
A. C. Edwards, J. Creasey, and M. S. Cresser.
In: Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium, September 1984. IAHS-AISH Publication No 150, 1984. p 187-202, 10 fig, 4 tab, 19 ref.

Descriptors: *Water sampling, *Chemical properties, *Hydrologic data collection, *Storm runoff, *Seasonal variation, *Regression analysis, *Cycling nutrients, Sampling, Automation, Planning, Catchment areas, Data collections, Storm water, Weathering, Sulfur, Data interpretation, Leaching, Nitrogen.

Strategies appropriate for sampling geochemical weathering rates of two typical upland drainage basins in the Grampian Region of North East Scotland are discussed. When planning a sampling program for the study of factors influencing the solute composition of natural waters or for the estimation of the net inputs and outputs of species to and from drainage basins, it is particularly important to assure sufficient sampling frequency over the winter months. Seasonal trends in concentration are of considerable importance in studies involving N cycling, and to a lesser extent, sulfate-S cycling. Sampling before and after storms is important because storm events can greatly alter the concentrations of certain stream constituents through dilution or leaching during overland flow. Since increasing sampling frequency is often unfeasible, regression equations may be employed to relate concentration to discharge. For detailed studies of changes in solute composition with time through precipitation events, the variability of rainwater composition with time, and, for larger basins, over the catchment, should not be overlooked. The operation of a simple, inexpensive mechanical device for automatic fractionation of precipitation and drainage water samples throughout storm events is described.
W86-03770

SUBSURFACE INVESTIGATION FOR DREDGING PROJECTS,
Canonie Engineers, Chesterton, IN.
R. F. Brissette.
IN: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/Japan Experts Meeting. March 1985. p 210-225, 5 fig, 1 tab, 3 ref.

Descriptors: *Dredging, Harbors, Test holes, Testing procedures, Tunnels, Tunneling, Channel improvement.

Dredging and tunnel projects have achieved considerable notoriety within the geotechnical community. On reviewing the history of many of these projects, it becomes apparent that the reputation arises not from a failure to adopt so-called 'state-of-the-art' technology, but rather a failure to organize investigations to address anticipated problems and to understand the significance of the data acquired. Even when these two elements are present, projects flounder when those charged with executing the work do not have a clear grasp of the engineering properties of the materials they are likely to encounter. As dredging techniques are more frequently being used to correct environmental problems, the techniques of investigation and data management will assume greater importance. The problems of establishing the types of data to be acquired, the extent of the data, and how it is to be used are still with us. Failure to address these problems rigorously results in excessive costs, unsatisfactory project results, and, in some cases, abandonment of projects altogether. Suggestions for methods to solve these problems are made. They include examination of the literature and of existing records, charting an investigative plan, and the appropriate use of laboratory analysis and geotechnical engineering. (Halterman-PTT)
W86-03881

7B. Data Acquisition

1981 CCOPE PROBE MESONET CALIBRATION AND MAINTENANCE PROCEDURES,
Montana Dept. of Natural Resources and Conservation, Helena.
L. Holman, and J. McInerney.
Technical Report, June 1983. 67 p, 11 fig, 6 tab, 5 ref, 3 append. 1-07-81-V0175.

Descriptors: *Measuring instruments, *Meteorological data collection, Data collection, Cooperative Convective Precipitation Experiment, Portable Remote Observation of the Environment mesonet, Calibration, Monitoring, Quality control, Wind, Temperature, Atmospheric pressure, Humidity, Precipitation, Maintenance.

Preparation and shutdown activities associated with the operation of the 1981 CCOPE (Cooperative Convective Precipitation Experiment) PROBE Mesonetwork involved testing and calibrating instruments to assure a quality data set. Data quality control was sought during all phases of the 1981 CCOPE PROBE Mesonetwork operations for wind speed, wind direction, temperature, pressure tendency, relative humidity, and precipitation instruments and for the electronic interfacing and transmission equipment. Testing of equipment began in August 1979 and continued through June 1982. Because of the prototype nature of the PROBE stations, many of the calibration procedures and techniques had not been thoroughly tested for operations in Montana. Subsequently, the further calibration and maintenance measures were at times by trial and error. Calibration and maintenance exhibited reasonable consideration for the many constraints encountered. As a result, the data quality for each parameter was generally good. Overall station performances were considered acceptable. (Author)
W86-03481

JOINT HYDROGEOLOGICAL SURVEYS,
GRW Engineers, Lexington, KY.
For primary bibliographic entry see Field 6E.
W86-03579

LOW COST HYDROLOGICAL DATA COLLECTION,
Institute of Hydrology, Wallingford (England).
I. Strangeways.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No 144, 1984. p 229-233, 2 fig, 3 append.

Descriptors: *Data aquisition, *Measuring instruments, *Gages, *Data collection, *Hydrological data collections, Water level, Sensors, Rain gages.

Low-cost hydrological instruments, a rain gage and a water level sensor, were devised for use in developing countries. The rain gage, made by vacuum-forming, has improved aerodynamic properties and a stainless steel rim. Its improved logger uses microchips, single-pole plugs instead of multi-pin plugs, and a magnetic probe instead of toggle switches. The sensor for measuring groundwater level uses a simplified bubble technique. A small-bore plastic tube is left between the well's outer casing and the inner pumping tube, terminating in a tube connector at the well head. Air is compressed by a bicycle pump into the air reservoir. As the air escapes to the well via an adjustable valve, it displaces water in the sensing tube. Air pressure in the tube rises until it reaches a constant value. The pressure is then read and correlated with depth.
W86-03581

CONTINUOUS MONITORING OF RAINFALL, STREAMFLOW AND SUSPENDED SEDIMENT CONCENTRATION IN SEMIARID ENVIRONMENTS,
Rhodes Univ., Grahamstown (South Africa). Dept. of Geography.
A. Van, B. Weaver, and D. A. Hughes.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 363-371, 1 fig, 2 tab, 11 ref.

Descriptors: *Data acquisition, *Measuring instruments, *Semiarid lands, *Monitoring, Gages, *Suspended sediments, *Rainfall, *Streamflow, Computers, Rain gages, Stream gages, Sediments, Hydrologic data collections, Turbidity, Data collections, Data storage and retrieval, Ecca River, South Africa, Water level recorders, Weirs.

Hydrological instruments used in semiarid lands must be designed to measure extremely wide ranges of weather events and must be suitable for remote, rarely attended locations. Weather commonly develops rapidly and lasts a short time. For example, sediment concentrations in semiarid rivers have varied from 4 to 40 g per liter within 50 min, resulting from 15 mm of rain falling within 24 min. Good accuracy at high and low values and the ability to record at short intervals (10 min or less) is very important. Variable recording is also desirable. This provides high resolution recording during rapidly changing conditions and long recording intervals during slow or zero changing conditions. For remote stations, equipment should have sufficient storage capacity and power supply, be simple to operate, and avoid the conventional clockwork recording systems. A microcomputer recording system was tested in five small drainage basins in the Ecca River region of South Africa. Two tipping bucket rain gages with variable sampling frequency have performed without failure for 9 months. Tests on a float-type streamflow recorder were not conclusive. Weirs designed for flow measurement in semiarid regions can be compound (with a sharp crested V-notch for low flows) or deep and narrow throated flumes. Sediment concentrations are measured with a three-component system: turbidity sensor, water level sensor, and recording unit. Although the probe became clogged and the vegetal detritus deposited in the weir throat, calibration showed a strong linear relationship between turbidity meter readings and sediment concentration.
W86-03591

REMOTE SENSING APPLICATIONS IN AFRICAN EROSION AND SEDIMENTATION STUDIES,
Reading Univ. (England). Dept. of Geography.
A. C. Millington, and J. R. G. Townshend.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No. 144, 1984. p 373-384, 2 fig, 2 tab, 15 ref.

Descriptors: *Remote sensing, *Satellite technology, *Aerial photography, *Vegetation, *Erosion, *Sedimentation, Soil erosion, Maps, Landsat, Soil loss, Sierra Leone, Senegal, Africa, Photography, Semiarid lands, Arid lands.

Several types of remote sensing imagery (aerial photography, Landsat 1-3, Landsat 4, and SPOT) were evaluated for use identifying erosion and sedimentation in Africa. All these have been successfully used or are feasible in the applications mentioned: splash erosion, sheet wash, rilling, gullying, mass movement, channel and bank erosion, and sedimentation within channels and lakes/impoundments. Identification of erosion is a function of the scale of the process and pixel size, the height of the sensor platform, the wavelength of the imagery, and the amount of vegetative cover. Direct observation is easy in arid and semiarid regions but difficult in the humid tropical biomes. Two case studies were described. Multitemporal monitoring of sediment source areas using vegetation mapping from NOAA-7 AVHRR showed the movement of the greenwave northward with the onset of the rains and the subsequent progressive die-back with

the onset of the dry season. Changes in land use in Sierra Leone were monitored by high flight aerial photography.
W86-03592

MULTI-PARAMETER REMOTE MEASUREMENT OF RAINFALL,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
For primary bibliographic entry see Field 2B.
W86-03618

INVESTIGATIONS OF LARGE SCALE STORM SYSTEMS: FINAL REPORT,
Air Force Geophysics Lab., Hanscom AFB, MA.
For primary bibliographic entry see Field 2B.
W86-03647

INVENTORY OF CANADIAN GLACIERS: PROCEDURES, TECHNIQUES, PROGRESS AND APPLICATIONS,
Environmental Protection Service, Ottawa (Ontario).
For primary bibliographic entry see Field 2C.
W86-03677

HYDROLOGICAL BASINS IN WEST GREENLAND AND THEIR RELATIONSHIP TO A PRELIMINARY SECTORIAL DIVISION OF THE INLAND ICE SHEET,
Groelands Geologiske Undersoegelse, Copenhagen (Denmark).
For primary bibliographic entry see Field 2C.
W86-03678

SOME PROBLEMS OF GLACIER INVENTORY IN THE HIMALAYAS,
For primary bibliographic entry see Field 2C.
W86-03680

PROBLEMS AND RESULTS OF STUDIES OF MOUNTAIN GLACIERS IN THE SOVIET UNION,
Akademiya Nauk SSSR, Moscow.
For primary bibliographic entry see Field 2C.
W86-03686

STUDIES OF GLACIER FLUCTUATIONS IN THE USSR,
For primary bibliographic entry see Field 2C.
W86-03687

SPECIAL PROBLEMS OF GLACIER INVENTORY IN AFGHANISTAN,
For primary bibliographic entry see Field 2C.
W86-03688

SOME COMMENTS ON THE SWISS GLACIER INVENTORY,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
For primary bibliographic entry see Field 2C.
W86-03690

PROBLEM OF A GLACIER INVENTORY OF ANTARCTICA,
British Antarctic Survey, Cambridge (England).
For primary bibliographic entry see Field 2C.
W86-03693

PARAMETERIZATION OF GLACIER EQUILIBRIUM LINE ALTITUDE,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
For primary bibliographic entry see Field 2C.
W86-03696

USE OF LANDSAT DIGITAL INFORMATION FOR ASSESSING GLACIER INVENTORY PARAMETERS,
Nebraska Univ. at Omaha. Remote Sensing Applications Lab.
For primary bibliographic entry see Field 2C.
W86-03702

SATELLITE IMAGE ATLAS OF GLACIERS,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2C.
W86-03703

DATA COLLECTION FOR HYDROCHEMICAL BALANCES: THEORETICAL ASPECTS,
Oslo Univ. (Norway). Inst. of Geophysics.
For primary bibliographic entry see Field 2A.
W86-03766

USE OF DIFFERENT PHYSICAL SEPARATION TECHNIQUES FOR TRACE ELEMENT SPECIATION STUDIES IN NATURAL WATERS,
Oslo Univ. (Norway). Dept. of Chemistry.
For primary bibliographic entry see Field 2K.
W86-03771

HYDROMETEOROLOGICAL DATA ACQUISITION: INNOVATIVE, HIGH-RESOLUTION PROGRAMMABLE INSTRUMENTATION FOR STORMWATER MANAGEMENT,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
W. James, H. Haro, M. A. Robinson, D. Henry, and R. Kitai.
In: Proceedings of Stormwater and Water Quality Management Modeling Users Group Meeting, March 25-26, 1982, Washington, DC. EPA-600/9-82-015, August 1982. p 128-151, 10 fig, 2 tab, 9 ref.

Descriptors: *Rainfall intensity, *Data acquisition, *Stormwater management, Water management, Meteorological data collections, Computer applications, Hydrologic data collections.

This project compares new and existing instrumentation for sensing and recording rainfall intensity at a high time resolution. The data logger incorporates an audio cassette unit for data retrieval and a single chip microcomputer programmed to record appropriate time series data in compact form. The data on the retrieved cassettes is input and stored on removable hard-disc packs via a PDP 1123 microcomputer through a specially devised decoder, also incorporating a single chip microcomputer. Special interactive FORTRAN applications software on the 1123, processes the time series data files and plots hyetographs on a desk-top plotter. Sample input/output is provided. The entire system is designed to be inexpensive, for use in real-time control. The system is being extended to monitor water depth (discharges), temperature, conductivity and pH.
W86-03829

7C. Evaluation, Processing and Publication

MATHEMATICAL ANALYSIS OF GROUNDWATER RESOURCES,
Canterbury Univ., Christchurch (New Zealand). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W86-03478

EVALUATION OF COMMUNITY INFORMATION INDICES FOR MISSISSIPPI RIVER FISHERIES,
Oak Ridge National Lab., TN. Environmental Sciences Div.
H. N. Polovino, M. P. Farrell, and C. H. Pennington.
Available from the National Technical Information Service, Springfield, VA 22161 as DE83-002588. ORNL/TM-8272, Publication No. 1950, November 1982. 62 p, 21 fig, 6 tab, 45 ref. W-7405-eng-26.

Descriptors: *Fish populations, *Species composition, *Species diversity, *Dikes, *Stream fisheries, Fisheries, Fish management, Sampling, Ecology, Temporal distribution, Spatial distribution, Seasonal variation, Comparison studies, Evaluations.

Historically, quantitative species diversity indices have been used to assess spatial and temporal changes in ecological communities. However, other classification schemes, namely binary similarity coefficients and quantitative dissimilarity measures, offer alternative methodologies for delineating community composition that may offer less sampling error. The study evaluates the relative performance of binary similarity coefficients, dissimilarity measures, and diversity indices, calculated for three sampling methods, in detecting changes in fish communities associated with two dike fields on the Mississippi River. Dike field fish communities were studied for five discrete hydrologic seasons based on water temperature and flow velocities. Dike field fish cmmunities were found to be least similar during high-water, low-temperature conditions. Electroshocking proved to be the single most representative gear type when compared to hoop net and seine data. Of the three families of community information measures, binary similarity coefficients proved to be the most sensitive indicators of change in dike field fish communities. Measures based on species presence/absence represent a valid alternative method for characterizing compositional change in community structure. This is especially true when species abundance data are highly variable, which is the case in many fisheries assessments. (Geiger-PTT)
W86-03499

USE OF LOG-NORMAL STATISTICS IN ENVIRONMENTAL MONITORING,
R. B. Dean.
IN: Chemistry in Water Reuse: Volume 1, Ann Arbor Science, Ann Arbor, MI. 1981. Edited by William J. Cooper. p 245-258, 7 fig, 3 tab, 15 ref.

Descriptors: *Data interpretation, *Pollutant identification, *Water analysis, *Statistical analysis, Log-normal distribution, Monitoring, Mathematical studies, Errors, Trace levels, Distribution patterns, Lake Tahoe.

Most real data obtained in analytical laboratories follow log-normal statistics. In order to make use of the most powerful statistics that are available the data should be transformed to logs. If log-normal data are treated as if they were normal, quite erroneous estimates of large deviations from the central value will be made. Conversely, if truly normal data are treated as log-normal, the errors will usually be small and conservative. One should justify in each case the use of normal statistics rather than log-normal on all data, such as concentrations, where values less than zero are impossible. (Author)
W86-03531

GROUND-WATER LEVELS IN ARKANSAS, SPRING 1984,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 2F.
W86-03553

DIRECTORY OF MEMBER ORGANIZATIONS OF THE NATIONAL WATER DATA EXCHANGE (NAWDEX),
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 10D.
W86-03557

HYDROGEOLOGICAL DATA COLLECTION, STORAGE, RETRIEVAL AND WATER LAW IN BOTSWANA,
Botswana Geological Survey, Lobatse.
M. Sekwale.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No 144, 1984. p 221-228, 1 append.

Descriptors: *Data collections, *Hydrologic data collections, *Water law, *Data storage and retrieval, Botswana, Boreholes, Regulations, Permits.

Botswana has required borehole registration and submission of all relevant borehole data for a decade. This allows hydrogeological data collection at reduced cost to the government. To date, almost 10,000 boreholes have been registered. Relevant information, kept by the Department of Geological Survey, is available to the public. Four storage and retrieval systems exist: borehole completion certificate files, borehole location maps, lithological samples, and hydrochemical data. Computerized information manipulation saves time and allows for more detailed analyses. A copy of the borehole completion certificate is included. W86-03580

USE OF THE DATA OF GLACIER INVENTORIES FOR COMPILATION OF THE WORLD ATLAS OF SNOW AND ICE RESOURCES,
Akademiya Nauk SSSR, Moscow.
For primary bibliographic entry see Field 2C.
W86-03701

STUDY OF THE SELECTION, CALIBRATION AND VERIFICATION OF MATHEMATICAL WATER QUALITY MODELS,
National Council of the Paper Industry for Air and Stream Improvement, Inc., Medford, MA.
For primary bibliographic entry see Field 5B.
W86-03823

8. ENGINEERING WORKS

8A. Structures

REVETMENT STABILITY STUDY, FORT FISHER STATE HISTORIC SITE, NORTH CAROLINA: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
D. G. Markle.
Technical Report HL-82-26, November 1982. Final Report. 93 p, 6 fig, 1 tab, 54 photos, 10 plates, 1 append.

Descriptors: *Hydraulic models, *Model studies, *Design criteria, *Breakwaters, *Structural engineering, Models, Revetments, Hydraulic structures, Gabions, Stability analysis, Wave action, Sea walls.

A hydraulic model study was conducted using a two-dimensional stability model at an undistorted linear scale of 1:24 to develop both special- and random-placed armon-stone revetment designs that would be stable for specified storm conditions, to determine the stability response of all plans to depth-limited breaking waves, and to check the stabilities of the optimum designs when exposed to depth-limited breaking waves. Test results showed that 5,900-lb, special placed and 8,600-lb, random-placed armor stones would be stable for the depth-limited breaking wave conditions produced at the +10.7 still-water level. The 5,900-lb, special-placed armor-stone design was tested on revetments that had a 30-ft-wide gabion toe and a 14-ft-wide Sta Pod toe and proved to be stable for both cases. The 8,600-lb, random-placed armor-stone design was only tested on the revetment with the 30-ft-wide gabion toe. The 30-ft-wide toe included a six-row gabion blanket and the 14-ft-wide toe used 8.919 lb Sta Pods as buttressing on the outer sea-side toe. All of the acceptable designs showed slightly higher degrees of damage, but none of them failed when exposed to depth-limited breaking waves at the +13.0 and +15.0 still-water levels. None of the designs showed any additional stability problems when exposed to the depth-limited, breaking waves at the +8.0 and +5.0 still-water levels. (Geiger-PTT)
W86-03479

PRESENT AND POTENTIAL USE OF MICRO-HYDRO-ELECTRIC SCHEMES IN REMOTE LOCATIONS,
Lincoln Coll. (New Zealand). Tussock Grasslands and Mountain Lands Inst.
R. J. Blakely, and K. F. O'Connor.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-904687. Price codes: A03 in paper copy, A01 in microfiche. NZERDC--68, October 1981. 43 p, 16 fig, 11 tab, 20 ref, 4 append. 3173.

Descriptors: *Hydroelectric plants, *New Zealand, *Powerplants, Electric power, Electric power production, Farm management, Turbines, Steam turbines, Hydraulic turbines.

The renewal of interest in the potential farm-application of water turbines in New Zealand within the past five to ten years has led to the development of management plans by which the water resources of small catchments could be conserved and used for local micro-hydro-electric power generation. The results of research to survey the present use of very small hydro-electric power schemes in remote locations of New Zealand and to assess the demand for recently developed small scale systems in such areas are discussed. Results indicate that only 10% of the farmers with appropriate water bodies are using hydroelectric power. However, replies from government departments, tourist facilities, and other private users indicated a very high interest in future use of small-scale hydroelectric power generation. (Halterman-PTT)
W86-03505

8C. Hydraulic Machinery

SOLAR POWERED GROUNDWATER PUMPING FOR MEDIUM HEADS,
Ward (Peter) and Associates, Vancouver (British Columbia).
P. R. B. Ward, and W. G. Dunford.
IN: Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium, July 1984. IAHS Publication No 144, 1984. p 249-258, 7 fig, 5 ref.

Descriptors: *Hydraulic machinery, *Pumps, *Solar energy, *Electrical equipment, Wells, Zimbabwe, Rural areas, Cavity pumps.

Solar-powered water pumps for remote locations in Zimbabwe have costs comparable to diesel-powered pumps. The electric-powered progressive cavity pump, already in use throughout Africa, is adaptable to solar power. Pumping requirements in this region of deep water tables and fractured crystalline rocks are 2.5 cu m per hour per 10-hour day at heads of 35-70 m. The pump uses a steel helical drive shaft turning in an outer rubber jacket and shaped in a double helix. It works with high efficiency at low speeds. It can pump water when working at a half or quarter of the design speed. With about 1 kW per sq m solar irradiation under conditions in Zimbabwe, 10.5 sq m of photovoltaic cells would be required to produce 2.5 cu m per hour of water at a head of 35 m. Use of a DC-DC converter can overcome the problem of obtaining sufficient torque to start the motor during periods of low radiation.
W86-03583

DISCHARGE FORECASTING FROM GLACIERIZED AREAS TO OPTIMIZE HYDROELECTRIC POWER MANAGEMENT,
Grande Dixence Societe Anonyme, Sion (Switzerland).
G. Dayer, and Y. Rey.
IN: Applied Climatology, Proceedings of the 25th International Geographical Congress Symposium No 18: Applied Geography, 1984. p 59-66, 2 fig, 4 tab, 22 ref.

Descriptors: *Runoff forecasting, *Snowmelt, *Model studies, Forecasting, Alpine regions, Glaciers, Ablation, Hydroelectric power.

High-head hydroelectric energy production in Switzerland derives its raw material essentially from snow and glacier meltwater, with water being stored in seasonal accumulation basins. Forecasting on both a long- and short-term basis is necessary to assess the probability of filling the basin. In this discussion, short-term (2-3 days) meltwater runoff is forecast in order to optimize pumping operations for the Grande Dixence S.A. power scheme, which is located in the pennine Alps. The prediction model uses the autoregressive moving average (ARMA) model techniques. A case study is presented in which the results of this method are applied to the Z'Mutt glacier's meltwater discharge. (Halterman-PTT)
W86-03848

8I. Fisheries Engineering

EVALUATION OF COMMUNITY INFORMATION INDICES FOR MISSISSIPPI RIVER FISHERIES,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 7C.
W86-03499

IMPOUNDED RIVERS: PERSPECTIVES FOR ECOLOGICAL MANAGEMENT,
Loughborough Univ. of Technology (England). Dept. of Geography.
For primary bibliographic entry see Field 6G.
W86-03516

PROCEDURE FOR DEVELOPING BIOLOGICAL INPUT FOR THE DESIGN, LOCATION, OR MODIFICATION OF WATER-INTAKE STRUCTURES,
Battelle Pacific Northwest Labs., Richland, WA.
D. A. Neitzel, and D. H. McKenzie.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-020946. Price codes: A05 in paper copy, A01 in microfiche. PNL-3688/UC-97e, December 1981. 83 p, 5 fig, 3 tab, 67 ref, 2 append. 14-16-0009-79 1401.

Descriptors: *Entrainment, *Fish ladders, *Design criteria, *Fish behavior, *Intake gates, Intakes, Environmental effects, Fish management, Shellfish, Ecological effects, Fish passages, Structural engineering, Structural models, Models.

The report reviews behavioral, physiological, and ecological literature of fish and shellfish. A compilation of data describing the relationship between environmental stimuli associated with water intake structures and behavioral and physiological responses of fish and shellfish is presented. The report set up a system to provide biological information for engineering models used to design, locate, or modify water intake structures. Examples of biological research that are potentially applicable to the design criteria presented are reviewed. The literature reviewed stresses the need for predictive laboratory studies and field verification studies for developing biological input into intake design and location. Two of the most important biological characteristics that need to be included in all research are ontological changes and the threshold limits of the species tested. As a fish or shellfish grows or develops, its response to stimuli will change. Biologists and engineers must understand this so biological data used related to the life stages of fish or shellfish most likely to be entrained or impinged. The threshold response of an organism to a stimulus must also be considered. The functions that relate the behavioral, physiological, and ecological information to the process of intake engineering must be developed and described. It will then be possible to describe the data requirements to develop further functions for biological characteristics of fish and shellfish relevant to the design, location, and operation of water intake structures. (Geiger-PTT)
W86-03519

AQUACULTURE IN DREDGED MATERIAL CONTAINMENT AREAS: PROCEEDINGS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.

For primary bibliographic entry see Field 2H.
W86-03704

SITE DESCRIPTION OF DREDGED MATERIAL CONTAINMENT AREAS: AN OVERVIEW OF PHYSICAL, CHEMICAL, BIOLOGICAL FEATURES,
Army Engineer District, Galveston, TX.
For primary bibliographic entry see Field 2H.
W86-03705

REVIEW OF SPECIES SUITABLE FOR CONTAINMENT SITE CULTURE (FRESH WATER),
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
For primary bibliographic entry see Field 2H.
W86-03706

POND MANAGEMENT: POLYCULTURE VS. MONOCULTURE,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
For primary bibliographic entry see Field 2H.
W86-03707

HEALTH AND DISEASE CONTROL FOR AQUATIC ANIMALS IN DREDGED MATERIAL CONTAINMENT SITES,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 5C.
W86-03709

POND DESIGN AND MANAGEMENT FOR COASTAL AQUACULTURE,
Alabama Dept. of Conservation and Natural Resources, Gulf Shores. Claude Peteet Mariculture Center.
For primary bibliographic entry see Field 2H.
W86-03710

MARICULTURE IN OLD RICE FIELD IMPOUNDMENTS: AN ANALOGY FOR DREDGED MATERIAL CONTAINMENT AREAS,
South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
For primary bibliographic entry see Field 2L.
W86-03711

DESIGN CRITERIA FOR AQUACULTURE PONDS ON DREDGED MATERIAL,
Soil Conservation Service, Washington, DC.
R. E. Highfill.
In: Aquaculture in Dredged Material Containment Areas: Proceedings, September 1982, Galveston, TX. Miscellaneous Paper D-83-2, October 1983. p 163-168, 3 tab, 2 ref.

Descriptors: *Ponds, *Dredging, *Aquaculture, *Aquatic habitats, *Fish ponds, *Fish farming, Lakes, Aquatic life, Aquatic animals, Design criteria, Spillways, Dams, Water depth.

Design criteria for aquaculture ponds constructed at dredged material sites are listed. The minimum elevation of the top of a pond embankment should be 1 ft above the water surface. The design height should also allow for wave action. Minimum embankment top widths depend on the height--6 ft wide for an embankment 10 ft or less in height, 15 ft wide for an embankment 35 ft or more in height. Spillways are necessary if runoff has no natural escape. Wells are the ideal water supply; the minimum rate should be 15-25 gal per min per surface acre. Depth depends on the species and climate. Most desirable depths in warm climates are as follows: channel catfish, 4-6 ft; crawfish, 1.5-2 ft; minnows and other bait fish, 4-6 ft; and trout, 3-5 for flowing water and 10-12 ft for still water. Extra depth should be allowed for ponds in cold climates. Pond bottoms should be smooth and sloped toward the outlet at a minimum of 2 ft per 100 ft.
W86-03713

AQUACULTURE AND DREDGED MATERIAL CONTAINMENT SITES: SIGNIFICANCE OF CONTAMINATED SEDIMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 5B.
W86-03714

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

ALGICIDES AND ALGAL MANAGEMENT AND CONTROL: BIBLIOGRAPHY,
Montana Univ., Missoula.
For primary bibliographic entry see Field 5G.
W86-03494

AQUACULTURE THESAURUS: DESCRIPTORS USED IN THE NATIONAL AQUACULTURE INFORMATION SYSTEM,
Virginia Inst. of Marine Science, Gloucester Point.
J. A. Lanier, F. L. Lawrence, E. V. Collins, and M. B. Hollinger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB268-760, Price codes: A07 in paper copy, A01 in microfiche. Virginia Institute of Marine Science Special Scientific Report 79, 1977. National Oceanic and Atmospheric Administration, Rockville, MD. Office of Sea Grant. 145 p, 14 ref. SG-04-06-158-44047.

Descriptors: *Thesauri, *Aquaculture, *Indexing, Information retrieval, Descriptors, Subject indexing.

The Aquaculture Thesaurus consists of the descriptors used in entering material into the National Aquaculture Information System (NAIS). Terms have been arranged in a format similar to that used in the Thesaurus of Water Resources Terms published by the U.S. Department of the Interior. The National Aquaculture Information System provides computer assisted access to a broad range of information on growig marine, brackish and freshwater organisms.
W86-03643

10D. Specialized Information Center Services

DIRECTORY OF MEMBER ORGANIZATIONS OF THE NATIONAL WATER DATA EXCHANGE (NAWDEX),
Geological Survey, Reston, VA. Water Resources Div.
C. D. Blackwell.
USGS Open-File Report 84-469, 1983. 66 p.

Descriptors: Organizations, *Information exchange, Information systems, *NAWDEX membership, Directories, *Information retrieval, *Data collections, *Data storage and retrieval.

The National Water Data Exchange (NAWDEX) is a national confederation of water-oriented organizations working together to improve access to water data. It consists of member organizations from all sectors of the water-data community. This Directory provides the names, addresses, and telephone numbers of all NAWDEX member organizations and their designated NAWDEX representatives. (USGS)
W86-03557

PROCEEDINGS: 2ND ANNUAL GULF OF MEXICO INFORMATION TRANSFER MEETING.
Minerals Management Service, Metairie, LA. Gulf of Mexico OCS Regional Office.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-900198. Price codes: A06 in paper copy, A01 im microfiche. Held April 30 - May 1, 1981, New Orleans, LA. Technical Report No 81-5-T, November 1981. 108 p, 16 fig, 5 tab, 2 append.

Descriptors: *Gulf of Mexico, *Information exchange, Marine biology, Biological oceanography, Marine resources, Marine environment, Marine fisheries, Marine geology, Ecological effects, Economic aspects, Ecology.

The meeting discussed here was held in order to provide a forum for exchange of current data and information generated through environmental studies in the Gulf of Mexico. Topics discussed include: topographic features; effects of oil and gas activities on reef fish populations; assessment of the IXTOC oil spill damage; economic aspects of the IXTOC I spill and BURMA AGATE spill; geology studies; recreational fisheries investigations; marine ecological mapping projects; deep sea biology; polychaete studies; southwest Florida shelf ecosystems studies; satellite oceanography; southwest Florida shelf circulation; coastal ecological characterizations; and endangered species studies. (Halterman-PTT)
W86-03841

MANAGEMENT OF BOTTOM SEDIMENTS CONTAINING TOXIC SUBSTANCES: PROCEEDINGS OF THE 9TH US/JAPAN EXPERTS MEETING.
Army Engineer Inst. for Water Resources, Fort Belvoir, VA.
For primary bibliographic entry see Field 5G.
W86-03867

10F. Preparation Of Reviews

MILITARY HYDROLOGY; REPORT 3: A REVIEW OF ARMY DOCTRINE ON MILITARY HYDROLOGY,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
D. L. Stinson.
Miscellaneous Paper EL-79-6, June 1981. Report 3 of a Series. 62 p, 1 tab, 1 append. 4A762719AT40.

Descriptors: *Hydrology, *Military hydrology, *Documentation, *Surface water, *Subsurface water, Doctrine, Meteorology, Soil water, Streamflow, Water supply.

Military hydrology is a specialized area of study that deals with the characteristics of surface and subsurface water features that may affect the planning and conduct of military operations. A study was conducted to review Army doctrine on military hydrology to determine its relevance to modern Army needs. Documents were reviewed with respect to five thrust areas: (1) organization, (2) meteorology, (3) soil moisture, (4) streamflow, and (5) water supply. It was found that many of the documents reviewed, including Army Regulations, Field Manuals, Technical Bulletins, and Technical Manuals, incorporated doctrinal concepts and technologies of the 1950's. Recommendations were made including suggestions on what modern methodologies and doctrinal concepts should be adopted and what changes can be made to facilitate better understanding of the documents. (Author)
W86-03456

EVALUATION OF THE PUBLISHED LITERATURE IN THE WATER REUSE/RECYCLE AREA,
Versar, Inc., Springfield, VA.
For primary bibliographic entry see Field 3E.
W86-03521

REMOVAL OF VARIOUS TOXIC HEAVY METALS AND CYANIDE FROM WATER BY MEMBRANE PROCESSES,
Trace Metal Data Inst., El Paso, TX.
For primary bibliographic entry see Field 5D.
W86-03532

SEDIMENT YIELDS OF AFRICAN RIVERS,
Exeter Univ. (England).
For primary bibliographic entry see Field 2J.
W86-03584

LITERATURE SURVEY OF RESERVOIR CONTAMINANT PROBLEMS,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 5B.
W86-03623

POTENTIAL BIOLOGICAL IMPACTS OF NAVIGATION TRAFFIC,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 6G.
W86-03645

SUBJECT INDEX

ACCUMULATION
Longitudinal Distribution of Trace Elements (As, Cd, Cr, Hg, Pb, and Se) in Fishes and Sediments in the Upper Mississippi River,
W86-03743 5B

Heavy Metal Accumulation in Selected Sessile Components of Fountain City Bay, Pool 5A, of the Upper Mississippi River,
W86-03744 5B

ACID-MINE WATER
Hydrology of Area 1, Eastern Coal Province, Pennsylvania,
W86-03547 2E

ACID RAIN
Hydrochemical Budgets of Some Dutch Woodland Soils with High Inputs of Atmospheric Acid Deposition: Mobilization of Aluminum,
W86-03774 5B

Physico-Chemical Characteristics of Surface Waters and Hydrological Behavior of a Small Granitic Basin (Vosges Massif, France): Annual and Daily Variations,
W86-03775 5B

Water Quality and Water Pollution Problems on the Indian Sub-Continent,
W86-03781 5B

ACIDIC SOILS
Hydrochemical Budgets of Some Dutch Woodland Soils with High Inputs of Atmospheric Acid Deposition: Mobilization of Aluminum,
W86-03774 5B

ACRYLAMIDE
Studies on Analytical Method of Acrylamide Monomer and Accumulation into Fish,
W86-03466 5B

Accumulation of Acrylamide into Fish,
W86-03878 5C

ACTIVATED CARBON
Control and Measurement of Organic Micropollutants in South African Water Reclamation Plants,
W86-03522 5A

Full Scale Experience with Activated Carbon Treatment of Joint Municipal - Industrial Wastewater,
W86-03892 5D

Textile Waste Treatment at a Municipal PACT Facility,
W86-03893 5D

ACTIVATED SLUDGE
Pollution Control: The Hidden Profit Centre,
W86-03671 5D

ACTIVATED SLUDGE PROCESS
Introduction to Wastewater Treatment Processes,
W86-03455 5D

Functional Design of Activated Sludge Processes,
W86-03670 5D

Procedures and Practices in Activated Sludge Process Control.
W86-03727 5D

Correlation of Process Control Strategues with Effluent BOD and Suspended Solids,
W86-03728 5D

Process Control Strategies,
W86-03729 5D

Understanding the Application of Analytical Data to Process Control,
W86-03730 5D

Computerization: Can It Work for You,
W86-03731 5D

Computer as a Tool for Activated Sludge,
W86-03732 5D

Relating BOD5 with On-Line Oxygen Uptake Rate Measurements Using Automatic Respirometers in View of Process Monitoring and Control,
W86-03733 5D

Design of Activated Sludge Facilities for Operating and Maintainability,
W86-03734 5D

Good Process Control: Planning and Implementation,
W86-03735 5D

Combined Nitrogen and Phosphorus Removal from Wastewaters,
W86-03844 5D

Post-Precipitation in Wastewater Treatment,
W86-03845 5D

ACTIVATED SLUDGE SYSTEM
Startup Critique of Sartell 3,
W86-03736 5D

ADMINISTRATION
WATER 2000: Conservation Program.
W86-03445 3D

ADSORBENTS
Transport of Contaminants from Energy Process Waste Leachates through Subsurface Soils and Soil Components Laboratory Experiments,
W86-03500 5B

ADSORPTION
Transport of Contaminants from Energy Process Waste Leachates through Subsurface Soils and Soil Components Laboratory Experiments,
W86-03500 5B

Results of a Solute Transport Experiment at Uvas Creek, September 1972,
W86-03556 2E

Role of Bottom Sediments in Modifying Soluble Phosphate Loads to a Dendritic, Hypertrophic Reservoir,
W86-03787 2J

AERATION
Aeration/Circulation for Control of Algal Production,
W86-03487 2G

Polysar Biological Oxidation Treatment Plant,
W86-03660 5D

Aeration Effects on Marine Eutrophication,
W86-03868 5G

Textile Waste Treatment at a Municipal PACT Facility,
W86-03893 5D

AERATION ZONE
Hydrogeochemical Evolution and Variability of Groundwater in Experimental Basins of S. W. Western Australia,
W86-03757 2F

AERATORS
Slime Growth on Fine Bubble Diffusers,
W86-03672 5D

AERIAL PHOTOGRAPHY
Remote Sensing Applications in African Erosion and Sedimentation Studies,
W86-03592 7B

Glacier Inventory of Bolivia,
W86-03676 2C

Inventory of Canadian Glaciers: Procedures, Techniques, Progress and Applications,
W86-03677 2C

Some Problems of Glacier Inventory in the Himalayas,
W86-03680 2C

AEROBIC CONDITIONS
Comparative Study of Sequential Redox Processes in Three British Aquifers,
W86-03758 2F

AFGHANISTAN
Special Problems of Glacier Inventory in Afghanistan,
W86-03688 2C

AGRICULTURAL CHEMICALS
Aerobic Transformation of Nitrogenous Substances in a Freshwater Ecosystem,
W86-03782 5C

AGRICULTURAL RUNOFF
Erosion of Agricultural Land - A Growing Water Quality Problem in Rural Areas,
W86-03780 5B

AGRICULTURAL WATERSHEDS
Erosion of Agricultural Land - A Growing Water Quality Problem in Rural Areas,
W86-03780 5B

Calibration of Hydrology and Sediment Transport on Small Agricultural Watersheds Using HSPF,
W86-03825 2J

AGRICULTURE
Hydrology and Land Use in Van Buren County, Michigan,
W86-03554 2E

Evaluation of Factors Influencing Water Erosion in West Africa Using Rainfall Simulation,
W86-03598 2J

Mulch Requirements for Erosion Control with the No-Till System in the Tropics: A Review,
W86-03600 4D

Indigenous Soil Conservation Studies in Sierra Leone,
W86-03603 4D

Nonpoint Nitrate Pollution of Municipal Water Supply Sources: Issues of Analysis and Control,
W86-03649 5G

Effects of Regional Water Management on N-Pollution in Areas with Intensive Agriculture,
W86-03650 5G

Hydrogeological Aspects of Groundwater Nitrification,
W86-03651 5B

Impact of Nitrogen Fertilizer Application on the Nitrate Concentration in Groundwater: Cost-Benefit Analysis Considerations,
W86-03652 5G

Integrated Physical-Economic Systems Analysis of Irrigated Agriculture,
W86-03658 5G

AIR POLLUTION
Lead and Cadmium in Precipitation in the Essex Region of Southwestern Ontario,
W86-03772 5B

Hydrochemical Budgets of Some Dutch Woodland Soils with High Inputs of Atmospheric Acid Deposition: Mobilization of Aluminum,
W86-03774 5B

ALCOHOLS
Development of Ethanol-Selective Membranes,
W86-03617 5D

ALGAE
Chemical and Physical Properties of Connecticut Lakes,
W86-03438 2H

Phytoplankton-Environmental Interactions in Reservoirs: Volume 1.
W86-03716 2H

Phytoplankton Effects of Reservoir Use,
W86-03722 5G

Use of Bioassay Approaches for Assessing Phytoplankton Growth in Lakes and Reservoirs,
W86-03723 5C

Relationship of Common Dominant Phytoplankton to Water Temperature and Season,
W86-03724 2H

Relationship of Common Phytoplankton Genera to Nutrients in Eastern and Southeastern Lakes,
W86-03725 2H

ALGAL CONTROL
Proceedings of Workshop on Algal Management and Control,
W86-03483 4A

Review of Control Measures for Objectional Algal 'Blooms',
W86-03484 5G

Selective Algicides,
W86-03485 5G

State-of-the-Art Summary of Phosphorus Inactivation as a Lake Restoration Technique,
W86-03486 5G

Aeration/Circulation for Control of Algal Production,
W86-03487 2G

Control of Non-Point Nutrient Caused Algal Problems Especially by Dilution,
W86-03488 5G

Limits to the Control of Algal Populations by Grazing Zooplankton: The Environmental Theater and the Ecological Play,
W86-03489 5G

Algal Control through Trophic-Level Interactions: A Subtropical Persepctive,
W86-03490 5G

Extracellular Metabolite Involvement in Plankton Community Structure,
W86-03491 2H

Cyanophages: Are They Potential Biological Control Agents of Nuisance Blue-Green Algae,
W86-03492 2H

Algicides and Algal Management and Control: Bibliography,
W86-03494 5G

ALGAL TOXINS
Review of Control Measures for Objectional Algal 'Blooms',
W86-03484 5G

ALGICIDES
Proceedings of Workshop on Algal Management and Control,
W86-03483 4A

Review of Control Measures for Objectional Algal 'Blooms',
W86-03484 5G

Selective Algicides,
W86-03485 5G

Algicides and Algal Management and Control: Bibliography,
W86-03494 5G

ALKALINITY
Alkalinity Feed Forward Control of Alum Addition in Wastewater Treatment,
W86-03666 5D

ALLUVIAL AQUIFER
Ground-Water Levels in Arkansas, Spring 1984,
W86-03553 2F

ALLUVIAL PLAINS
Respiratory Gas Content (O2 and CO2) and Ionic Composition of River Water in the Plain of Alsace (Eastern France),
W86-03763 2F

ALPINE REGIONS
Applied Climatology.
W86-03846 2B

View on Our Knowledge of Water Resources in Relation to Climate in the Alps,
W86-03847 2B

Regional Water Balance in the Mountainous Arctic and Its Application for Water-Resource Planning,
W86-03849 2D

ALUM
Alkalinity Feed Forward Control of Alum Addition in Wastewater Treatment,
W86-03666 5D

ALUMINUM
Hydrochemical Budgets of Some Dutch Woodland Soils with High Inputs of Atmospheric Acid Deposition: Mobilization of Aluminum,
W86-03774 5B

ALUMINUM SULFATE
State-of-the-Art Summary of Phosphorus Inactivation as a Lake Restoration Technique,
W86-03486 5G

AMMONIA
Establishment of an Ammonia Effluent Limitation for the Twin Cities Metro Plant,
W86-03748 5B

AMPHIBIANS
Large-Scale Operations Management Test of Use of the White Amur for Control of Problem Aquatic Plants, Report 1: Baseline Studies, Volume V, The Herpetofauna of Lake Conway, Florida,
W86-03458 2H

ANAEROBIC CONDITIONS
Comparative Study of Sequential Redox Processes in Three British Aquifers,
W86-03758 2F

ANAEROBIC DIGESTION
Proceedings of the 6th Symposium on Wastewater Treatment,
W86-03659 5D

Comparison of Stirred Suspension and Fixed Film Anaerobic Digestion Systems,
W86-03668 5D

ANDES
Glaciers and Glaciolithic Systems of the Central Andes,
W86-03675 2C

ANIONS
Studies on Groundwater Transport in Fractured Crystalline Rock under Controlled Conditions Using Nonradioactive Tracers,
W86-03497 2F

Study of the Hydrochemical Regime and Its Long-Term Variations in the Case of Some Rivers in U.S.S.R.,
W86-03778 2K

Study of Anthropogenic Influence on Water Quality in Some Rivers of the Baltic Sea Basin,
W86-03779 5B

ANTARCTIC
Glacier Balances in the Dry Valleys Area, Victoria Land, Antarctica,
W86-03694 2C

ANTARCTICA
Problem of a Glacier Inventory of Antarctica,
W86-03693 2C

ANTIBIOTICS
Extracellular Metabolite Involvement in Plankton Community Structure,
W86-03491 2H

AQUACULTURE
Aquaculture Thesaurus: Descriptors Used in the National Aquaculture Information System,
W86-03643 10C

Aquaculture in Dredged Material Containment Areas: Proceedings,
W86-03704 2H

Site Description of Dredged Material Containment Areas: An Overview of Physical, Chemical, Biological Features,
W86-03705 2H

Review of Species Suitable for Containment Site Culture (Fresh Water),
W86-03706 2H

Pond Management: Polyculture vs. Monoculture,
W86-03707 2H

Pond Management: Water Quality Criteria and Control,
W86-03708 5G

Health and Disease Control for Aquatic Animals in Dredged Material Containment Sites,
W86-03709 5C

Pond Design and Management for Coastal Aquaculture,
W86-03710 2H

Mariculture in Old Rice Field Impoundments: An Analogy for Dredged Material Containment Areas,
W86-03711 2L

Selection Criteria and Procedures for Establishing Mariculture Facilities in Existing Containment Sites,
W86-03712 5C

Design Criteria for Aquaculture Ponds on Dredged Material,
W86-03713 8I

Aquaculture and Dredged Material Containment Sites: Significance of Contaminated Sediments,
W86-03714 5B

Legal Environment of a Containment Site: Laws Governing the Acquisition, Maintenance, and Operation of Dredged Material Disposal Sites,
W86-03715 6E

Beneficial Uses of Dredged Material: Aquaculture in Dredged Material Containment Areas,
W86-03882 5E

AQUATIC ANIMALS
Polychlorinated Biphenyls and Organochlorine Insecticides in Great Blue Heron and Great Egret Eggs from the Upper Mississippi River,
W86-03747 5B

AQUATIC BACTERIA
Utilization of Bacteria in Managing Cyanobacterial Populations: A Review and Update,
W86-03493 2H

AQUATIC ENVIRONMENT
Hydrologic Transport Modeling,
W86-03427 5B

AQUATIC HABITATS
Evaluating Changes in Dike Field Fishes with Community Information Indices,
W86-03628 7A

Aquaculture in Dredged Material Containment Areas: Proceedings,
W86-03704 2H

Site Description of Dredged Material Containment Areas: An Overview of Physical, Chemical, Biological Features,
W86-03705 2H

Review of Species Suitable for Containment Site Culture (Fresh Water),
W86-03706 2H

Pond Management: Polyculture vs. Monoculture,
W86-03707 2H

Pond Management: Water Quality Criteria and Control,
W86-03708 5G

Health and Disease Control for Aquatic Animals in Dredged Material Containment Sites,
W86-03709 5C

Pond Design and Management for Coastal Aquaculture,
W86-03710 2H

Mariculture in Old Rice Field Impoundments: An Analogy for Dredged Material Containment Areas,
W86-03711 2L

Selection Criteria and Procedures for Establishing Mariculture Facilities in Existing Containment Sites,
W86-03712 5C

Design Criteria for Aquaculture Ponds on Dredged Material,
W86-03713 8I

Aquaculture and Dredged Material Containment Sites: Significance of Contaminated Sediments,
W86-03714 5B

Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium.
W86-03737 6G

Ecological History of the Upper Mississippi River,
W86-03738 6G

Role of Contaminants in the Decline of the Illinois River: Implications for the Upper Mississippi,
W86-03739 6G

Recent Rates of Sedimentation in the Mississippi River,
W86-03741 2J

Problems on the Upper Mississippi River and Its Tributaries: Need for a Long-Term Resource Monitoring Program,
W86-03751 7A

Contaminants in the Upper Mississippi River: Summary and Conclusions,
W86-03752 6G

AQUATIC LIFE
Induced Change and Its Impact on Aquatic Community Quality in the Sangamon River Basin of Illinois,
W86-03453 5G

Potential Biological Impacts of Navigation Traffic,
W86-03645 6G

Trace Elements in the Water, Sediments, and Fish of the Upper Mississippi River, Twin Cities Metropolitan Area,
W86-03745 5B

AQUATIC PLANTS
Preliminary Guide to the Onsite Identification and Delineation of the Wetlands of the South Atlantic United States,
W86-03480 2H

Preliminary Guide to the Onsite Identification and Delineation of the Wetlands of the Interior United States.
W86-03482 2H

Heavy Metal Accumulation in Selected Sessile Components of Fountain City Bay, Pool 5A, of the Upper Mississippi River,
W86-03744 5B

AQUATIC POPULATIONS
Induced Change and Its Impact on Aquatic Community Quality in the Sangamon River Basin of Illinois,
W86-03453 5G

AQUATIC WEED CONTROL
Large-Scale Operations Management Test of Use of the White Amur for Control of Problem Aquatic Plants, Report 1: Baseline Studies, Volume V, The Herpetofauna of Lake Conway, Florida,
W86-03458 2H

AQUIFER CHARACTERISTICS
Investigation of the Feasibility of Secondary Recovery of Ground Water from the Ogallala Aquifer: A Report to the Sixty-Eighth Legislature.
W86-03442 3B

AQUIFERS
Ground-Water Conditions of the Triassic Aquifer in Deaf Smith and Swisher Counties,
W86-03439 2F

Investigation of the Feasibility of Secondary Recovery of Ground Water from the Ogallala Aquifer: A Report to the Sixty-Eighth Legislature.
W86-03442 3B

Ground-Water Levels in Arkansas, Spring 1984,
W86-03553 2F

Groundwater Resources in Tropical African Regoliths,
W86-03564 2F

Character of Fractured Rock Aquifers in Eastern Botswana,
W86-03565 2F

Some Critical Issues with Monitoring Crystalline Rock Aquifers for Groundwater Management in Rural Areas,
W86-03567 2F

Characteristics of the Weathered Basement Aquifer in Malawi in Relation to Rural Water Supplies,
W86-03568 2F

Electric Logs for Groundwater Exploration in the Niger Delta.
W86-03570 2F

Gully Erosion in the Agulu-Nanka Region of Anambra State, Nigeria,
W86-03589 2J

Consequence Assessment of Hydrological Communications through Borehole Plugs,
W86-03629 5G

Nitrate Pollution of Groundwater Resources: Mechanisms and Modelling,
W86-03656 5B

Comparative Study of Sequential Redox Processes in Three British Aquifers,
W86-03758 2F

Groundwater Quality Evolution in the Upper Aquifer of the Coastal Dune Area of the Western Netherlands,
W86-03761 2F

Respiratory Gas Content (O2 and CO2) and Ionic Composition of River Water in the Plain of Alsace (Eastern France),
W86-03763 2F

ARCHEOLOGY
Human Adaptation Along the Columbia River 4700-1600 BP.: A Report of Test Excavation at River Mile 590, North Central Washington,
W86-03460 6E

AREAL RESISTANCE
Preparation of Ion-Exchange Membranes with Extremely Low Areal Resistances,
W86-03615 3A

ARGENTINA
East-West and North-South Snow Line Gradients in the Northern Patagonian Andes, Argentina,
W86-03674 2C

Glaciers and Glaciolithic Systems of the Central Andes,
W86-03675 2C

ARID-ZONE HYDROLOGY
Hydrochemical Relationships Between Rainwater, Floods, Groundwater and Lithology in the Avedat Group on the Negev Highlands, Israel,
W86-03789 2A

ARIKAREE FORMATION
Geologic and Hydrologic Data from a Test-Drilling Program in the High Plains Areas of South Dakota, 1979-1980,
W86-03558 2F

ARKANSAS
Ground-Water Levels in Arkansas, Spring 1984,
W86-03553 2F

AROMATIC COMPOUNDS
Determination of Polycyclic Aromatic Hydrocarbons in Industrial Discharges and Other Aqueous Effluents,
W86-03506 5A

Thermal Desorption from a XAD-4 Adsorption Substrate for Water Analysis by Capillary Gas Chromatography,
W86-03811 5A

Comparison of Several Methods for Collection and Quantification of Polycyclic Aromatic Hydrocarbons from Aqueous Media,
W86-03812 5A

ARTIFICIAL RECHARGE
Chemical and Microbiological Monitoring of a Sole-Source Aquifer Intended for Artificial Recharge, Nassau County, New York,
W86-03527 5A

ASSAYS
Effect of Soil on the Mutagenic Properties of Waste Water,
W86-03502 5C

ATCHAFALAYA RIVER
Comparison of Effectiveness of Management Options for Wetland Loss in the Coastal Zone of Louisiana,
W86-03866 2L

ATMOSPHERIC WATER
Investigations of Large Scale Storm Systems: Final Report,
W86-03647 2B

AUTOMATION
Alkalinity Feed Forward Control of Alum Addition in Wastewater Treatment,
W86-03666 5D

BACTERIA
Aerobic Transformation of Nitrogenous Substances in a Freshwater Ecosystem,
W86-03782 5C

BAFFLES
Waterloo Clarifier: Principles and Practice,
W86-03663 5D

BANK EROSION
Wetland Loss Directly Associated with Canal Dredging in the Louisiana Coastal Zone,
W86-03854 6G

Canals and Wetland Erosion Rates in Coastal Louisiana,
W86-03855 6G

BARRIER ISLAND
Sand Dune Vegetation and Stabilization in Louisiana,
W86-03864 2J

BASELINE STUDIES
Large-Scale Operations Management Test of Use of the White Amur for Control of Problem Aquatic Plants, Report 1: Baseline Studies, Volume V, The Herpetofauna of Lake Conway, Florida,
W86-03458 2H

Distribution and Relative Abundance of Fishes in Wisconsin; V: Grant and Platte, Coon and Bad Axe, and LaCrosse River Basins,
W86-03501 6G

BATCH REACTORS
Application of Biological Batch Reactor Technology in Wastewater Treatment,
W86-03665 5D

BAYS
Currents in Suisun Bay,
W86-03448 2L

Currents in San Pablo Bay,
W86-03449 2L

BEACH EROSION
Assessment of Geological and Human Factors Responsible for Louisiana Coastal Barrier Erosion,
W86-03852 2J

Effects of Coastal Structures on Shoreline Stabilization and Land Loss - The Texas Experience,
W86-03863 2L

Sand Dune Vegetation and Stabilization in Louisiana,
W86-03864 2J

BIBLIOGRAPHIES
Algicides and Algal Management and Control: Bibliography,
W86-03494 5G

Onshore Impacts of Offshore Hydrocarbon Development: Annotated Bibliography,
W86-03620 5C

BIOACCUMULATION
Stable Activable Tracers for Environmentally Significant Organic Molecules,
W86-03805 5A

BIOASSAY
Use of Bioassay Approaches for Assessing Phytoplankton Growth in Lakes and Reservoirs,
W86-03723 5C

BIOCHEMICAL OXYGEN DEMAND
Application of Biological Batch Reactor Technology in Wastewater Treatment,
W86-03665 5D

Slime Growth on Fine Bubble Diffusers,
W86-03672 5D

Relating BOD5 with On-Line Oxygen Uptake Rate Measurements Using Automatic Respirometers in View of Process Monitoring and Control,
W86-03733 5D

BIOCONTROL
Proceedings of Workshop on Algal Management and Control,
W86-03483 4A

Review of Control Measures for Objectional Algal 'Blooms',
W86-03484 5G

Algal Control through Trophic-Level Interactions: A Subtropical Persepctive,
W86-03490 5G

Cyanophages: Are They Potential Biological Control Agents of Nuisance Blue-Green Algae,
W86-03492 2H

BIODEGRADATION
Use of Aquatic Macrophytes for Sludge Treatment,
W86-03669 5D

BIOFILTERS
Pilot-Scale Evaluation of the Nutrient Film Technique for Wastewater Treatment,
W86-03515 5D

BIOFILTRATION
Pilot-Scale Assessment of the Biological Fludized Bed Process for Municipal Wastewater Treatment,
W86-03631 5D

BIOLOGICAL WASTEWATER TREATMENT
Introduction to Wastewater Treatment Processes,
W86-03455 5D

Pilot-Scale Evaluation of the Nutrient Film Technique for Wastewater Treatment,
W86-03515 5D

Pilot-Scale Assessment of the Biological Fludized Bed Process for Municipal Wastewater Treatment,
W86-03631 5D

Proceedings of the 6th Symposium on Wastewater Treatment,
W86-03659 5D

Polysar Biological Oxidation Treatment Plant,
W86-03660 5D

Application of Biological Batch Reactor Technology in Wastewater Treatment,
W86-03665 5D

Comparison of Stirred Suspension and Fixed Film Anaerobic Digestion Systems,
W86-03668 5D

BLOWOUTS
Deep-Water Blowout Trajectory Models for the Lancaster Sound Region,
W86-03638 5B

BOGS
Changes in Ground-Water Chemical Composition in Drained Peat Bogs in Connection with Environmental Protection Measures,
W86-03764 2F

BOLIVIA
Glacier Inventory of Bolivia,
W86-03676 2C

BOREHOLES
Electric Logs for Groundwater Exploration in the Niger Delta.
W86-03570 2F

Performance of Sanitary Completion Measures of Wells and Boreholes Used for Rural Water Supplies in Malawi,
W86-03582 5G

Consequence Assessment of Hydrological Communications through Borehole Plugs,
W86-03629 5G

BOTTOM SEDIMENTS
Role of Bottom Sediments in Modifying Soluble Phosphate Loads to a Dendritic, Hypertrophic Reservoir,
W86-03787 2J

BOUNDARY LAYERS
Separation of Boundary Layer and Flow Turbulence of Center-Feed Circular Sedimentation Basins,
W86-03830 5D

BREAKWATERS
Revetment Stability Study, Fort Fisher State Historic Site, North Carolina: Hydraulic Model Investigation,
W86-03479 8A

BUBBLES
Slime Growth on Fine Bubble Diffusers,
W86-03672 5D

CADMIUM
Lead and Cadmium in Precipitation in the Essex Region of Southwestern Ontario,
W86-03772 5B

CALCIUM
Hydrochemistry of Springs from Dolomite Reefs in the Southern Alps of Northern Italy,
W86-03765 2K

CALIBRATION
Study of the Selection, Calibration and Verification of Mathematical Water Quality Models,
W86-03823 5B

CALIBRATIONS
Calibration of Hydrology and Sediment Transport on Small Agricultural Watersheds Using HSPF,
W86-03825 2J

CALIFORNIA
Water Recycling in the Pulp and Paper Industry in California,
W86-03437 3E

Currents in Suisun Bay,
W86-03448 2L

Currents in San Pablo Bay,
W86-03449 2L

Results of a Solute Transport Experiment at Uvas Creek, September 1972,
W86-03556 2E

CANADA
Inventory of Canadian Glaciers: Procedures, Techniques, Progress and Applications,
W86-03677 2C

CANALS
Wetland Loss Directly Associated with Canal Dredging in the Louisiana Coastal Zone,
W86-03854 6G

Canals and Wetland Erosion Rates in Coastal Louisiana,
W86-03855 6G

CARBON DIOXIDE
Carbon Dioxide in the Soil Atmosphere: Simulation Model Parameter Estimation from Field Measurements,
W86-03755 2G

Hydrochemical Processes in Groundwater Discharge Areas,
W86-03762 2F

Respiratory Gas Content (O2 and CO2) and Ionic Composition of River Water in the Plain of Alsace (Eastern France),
W86-03763 2F

CARCINOGENS
Removal of Chemical Carcinogens from Water/Wastewater by Reverse Osmosis,
W86-03536 5D

CARP
Polychlorinated Biphenyls (PCBs) in Common Carp (Cyprinus carpio) of the Upper Mississippi River,
W86-03746 5B

CASE STUDIES
Pollution Control: The Hidden Profit Centre,
W86-03671 5D

CATCHMENT AREAS
Mass-Balance Approach to the Understanding of Geochemical Processes in Aqueous Systems,
W86-03773 5B

CATION EXCHANGE
Groundwater Quality Evolution in the Upper Aquifer of the Coastal Dune Area of the Western Netherlands,
W86-03761 2F

CATIONS
Study of the Hydrochemical Regime and Its Long-Term Variations in the Case of Some Rivers in U.S.S.R.,
W86-03778 2K

Study of Anthropogenic Influence on Water Quality in Some Rivers of the Baltic Sea Basin,
W86-03779 5B

Model Experimental Study of Hydrochemical Processes in the Saturated Zone,
W86-03785 2K

CELLULOSE ACETATE
Comparison of Stirred Suspension and Fixed Film Anaerobic Digestion Systems,
W86-03668 5D

CENTRIFUGATION
Use of Different Physical Separation Techniques for Trace Element Speciation Studies in Natural Waters,
W86-03771 2K

CHANNEL IMPROVEMENT
Ecological History of the Upper Mississippi River,
W86-03738 6G

Role of Contaminants in the Decline of the Illinois River: Implications for the Upper Mississippi,
W86-03739 6G

CHANNEL IMPROVEMENTS
Influence of Channel Regulating Structures on Fish and Wildlife Habitat: Appendix - Volume I, Figures and Photographs.
W86-03509 6G

CHANNELING
Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium.
W86-03737 6G

Contaminants in the Upper Mississippi River: Summary and Conclusions,
W86-03752 6G

CHANNELS
Predicting the Sediment Capacity of a Channel,
W86-03594 2J

Investigation of Effects of Navigation Traffic Activities on Hydrologic, Hydraulic, and Geomorphic Characteristics in the Upper Mississippi River System,
W86-03750 5B

CHEMCONTROL
Selective Algicides,
W86-03485 5G

CHEMICAL DEGRADATION
Mathematical Model, SERATRA, for Sediment-Contaminant Transport in Rivers and Its Application to Pesticide Transport in Four Mile and Wolf Creeks in Iowa,
W86-03648 5B

CHEMICAL PRECIPITATION
Alkalinity Feed Forward Control of Alum Addition in Wastewater Treatment,
W86-03666 5D

Some Implication of the Role of Kinetics in Enhancing Element Transport,
W86-03760 2K

Publications of the Water Research Institute, 58.
W86-03842 5D

Rapid Filtration as a Supplementary Treatment of Domestic Sewage,
W86-03843 5D

CHEMICAL PROPERTIES
Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium.
W86-03753 5B

Role of Natural Organics on Water Interaction with Soil and Rock,
W86-03754 2K

Hydrochemical Processes in Groundwater Discharge Areas,
W86-03762 2F

Changes in Ground-Water Chemical Composition in Drained Peat Bogs in Connection with Environmental Protection Measures,
W86-03764 2F

Hydrochemistry of Springs from Dolomite Reefs in the Southern Alps of Northern Italy,
W86-03765 2K

Data Collection for Hydrochemical Balances: Theoretical Aspects,
W86-03766 2A

Temporal Changes in Ground Water Quality in the Phreatic Zone Uttar Pradesh (India) and Their Impact on Sampling Schedule,
W86-03768 2F

Conditions and Frequency of Sampling for Elucidations of Transport Mechanisms and Element Budgets in Upland Drainage Basins,
W86-03770 7A

Mass-Balance Approach to the Understanding of Geochemical Processes in Aqueous Systems,
W86-03773 5B

Geochemical Studies in the Drainage Basin of the Rio Vouga (Portugal). I. General Hydrogeochemistry from Its Origin to the Ria de Aveiro,
W86-03776 2K

Hydrochemical Relationships Between Rainwater, Floods, Groundwater and Lithology in the Avedat Group on the Negev Highlands, Israel,
W86-03789 2A

CHEMICAL REACTIONS
Simulation of Physicochemical Interactions in a Water-Rock System in Assessing Ground-Water Quality,
W86-03759 2K

Mass-Balance Approach to the Understanding of Geochemical Processes in Aqueous Systems,
W86-03773 5B

Evaluation of the Intensity of Some Recent Exogenic Geological Processes in the U.S.S.R. by the Hydrogeochemical Balances Method,
W86-03777 2K

CHEMICAL WASTEWATER
Removal of Chemical Carcinogens from Water/Wastewater by Reverse Osmosis,
W86-03536 5D

CHESAPEAKE BAY
Verification of the Chesapeake Bay Model: Chesapeake Bay Hydraulic Model Investigation,
W86-03459 2L

CHINA
Distribution, Features and Variations of Glaciers in China,
W86-03684 2C

Recent Research on Glaciers on the Chinhai-Tibet Plateau,
W86-03685 2C

CHLORINATED HYDROCARBONS
Analysis of Chlorinated Organic Compounds Formed During Chlorination of Wastewater Products,
W86-03496 5A

Reduction of Trihalomethane Production with Optimal Disinfection Through Alternative Disinfection Systems,
W86-03542 5F

Analysis of Polychlorinated Biphenyls by Glass Capillary and Packed-Column Chromatography,
W86-03802 5A

Further Optimization of the Pentane Liquid-Liquid Extraction Method for the Analysis of Trace Organic Compounds in Water,
W86-03808 5A

Extraction of Organic Compounds from Water Using Small Amounts of Solvent,
W86-03809 5A

CHLORINE
Selective Algicides,
W86-03485 5G

Rational Approaches in the Analysis of Chemical Disinfection Kinetics,
W86-03538 5D

Biological Evaluation of Methods for the Determination of Free Available Chlorine,
W86-03539 5A

CHLORINE

Reduction of Trihalomethane Production with Optimal Disinfection Through Alternative Disinfection Systems,
W86-03542 5F

CHLORINE DIOXIDE
Chlorine Dioxide Chemistry: Generation and Residual Analysis,
W86-03540 5F

Determination of Chlorine Dioxide,
W86-03541 5A

CHLOROPHYLL
DCMU-Enhanced Chlorophyll Fluorescence as an Indication of the Physiological Status of Reservoir Phytoplankton: An Initial Evaluation,
W86-03721 2H

CHLOROPHYLL-A
Chemical and Physical Properties of Connecticut Lakes,
W86-03438 2H

CHROMATOGRAPHY
Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1.
W86-03791 5A

Master Analytical Scheme: An Overview of Interim Procedures,
W86-03793 5A

Master Analytical Scheme: Development of Effective Techniques for Isolation and Concentration of Organics in Water,
W86-03794 5A

Master Analytical Scheme: An Assessment of Factors Influencing Precision and Accuracy of Gas Chromatography/Mass Spectrometry Data,
W86-03795 5A

Part-per-Trillion Analysis of Volatile, Base/Neutral and Acidic Water Contaminants on a Single Fused-Silica Capillary Column,
W86-03801 5A

CHROMIUM
Coupled Transport Membranes for Removal of Chromium from Electroplating Rinse Solutions,
W86-03534 5D

CLARIFICATION
Dissolved Air Flotation for Primary and Secondary Clarification,
W86-03611 5D

Waterloo Clarifier: Principles and Practice,
W86-03663 5D

CLARIFIERS
Waterloo Clarifier: Principles and Practice,
W86-03663 5D

CLAY LOAMS
Effect of Soil on the Mutagenic Properties of Waste Water,
W86-03502 5C

CLEANUP OPERATIONS
Fate of Oil and Dispersant Mixtures in Freshwater,
W86-03637 5B

CLIMATIC DATA
Glaciers and Glaciolithic Systems of the Central Andes,
W86-03675 2C

View on Our Knowledge of Water Resources in Relation to Climate in the Alps,
W86-03847 2B

CLIMATOLOGY
East-West and North-South Snow Line Gradients in the Northern Patagonian Andes, Argentina,
W86-03674 2C

Climatic Background to Some Glacier Fluctuations,
W86-03699 2C

Applied Climatology.
W86-03846 2B

CLOUD PHYSICS
Ice Forming Experiment,
W86-03641 2C

Investigations of Large Scale Storm Systems: Final Report,
W86-03647 2B

CLOUD SEEDING
SCPP Forecasting Support for the Period 1 December 1978 through 30 September 1984,
W86-03495 3B

COAL GASIFICATION
Wastewater Treatment System for a Lurgi Coal Gasification Plant,
W86-03639 5D

COAL MINING
Surface Erosion and Sediment Control at Open-Cast Mines in Southern Africa,
W86-03602 4D

COASTAL MARSHES
Effects of Wetland Deterioration on the Fish and Wildlife Resources of Coastal Louisiana,
W86-03857 2L

Some Consequences of Wetland Modification to Louisiana's Fisheries,
W86-03858 2L

COASTAL STRUCTURES
Effects of Coastal Structures on Shoreline Stabilization and Land Loss - The Texas Experience,
W86-03863 2L

COASTAL ZONE MANAGEMENT
Onshore Impacts of Offshore Hydrocarbon Development: Annotated Bibliography,
W86-03620 5C

COLIFORMS
Continuous Simulation of Instream Fecal Coliform Bacteria,
W86-03837 5B

COMPARISON STUDIES
Comparison of Stirred Suspension and Fixed Film Anaerobic Digestion Systems,
W86-03668 5D

COMPLIANCE
Status Report on Compliance with the Chlor-Alkali Mercury Liquid Effluent Regulations 1978-79,
W86-03613 5D

COMPOSTING
Final Environmental Impact Statement for Sludge Disposal for the Des Moines Integrated Community Area,
W86-03635 5E

COMPUTER MODELS
Evaluation of Future Base-Flow Water-Quality Conditions in the Hillsborough River, Florida,
W86-03546 5B

Application Guide for Hydrological Simulation Program: FORTRAN (HSPF),
W86-03614 2A

Comparison of Soil Moisture Characteristics Predicted by the Arya-Paris Model with Laboratory-Measured Data,
W86-03636 2G

User's Manual for EXPLORE-I: A River Basin Water Quality Model, Hydraulic Module Only,
W86-03646 2A

Role of Bottom Sediments in Modifying Soluble Phosphate Loads to a Dendritic, Hypertrophic Reservoir,
W86-03787 2J

Proceedings of Stormwater and Water Quality Management Modeling Users Group Meeting.
W86-03822 5B

Dynamic Model Adjustment,
W86-03831 2A

Improved Surcharge Computation, in EXTRAN,
W86-03832 3A

Desk Top Methodology for Nonpoint Source Load Evaluation,
W86-03836 5B

COMPUTER PROGRAM
Desk Top Methodology for Nonpoint Source Load Evaluation,
W86-03836 5B

COMPUTER PROGRAMS
Application Guide for Hydrological Simulation Program: FORTRAN (HSPF),
W86-03614 2A

User's Manual for the Instream Sediment-Contaminant Transport Model SERATRA,
W86-03630 5B

Comparison of Soil Moisture Characteristics Predicted by the Arya-Paris Model with Laboratory-Measured Data,
W86-03636 2G

User's Manual for EXPLORE-I: A River Basin Water Quality Model, Hydraulic Module Only,
W86-03646 2A

Improved Surcharge Computation, in EXTRAN,
W86-03832 3A

Continuous Simulation of Instream Fecal Coliform Bacteria,
W86-03837 5B

Atmospheric Pollution in Relation to Storm Water Quality Modelling: Literature Review for an Industrial City,
W86-03838 5B

COMPUTERS
Procedures and Practices in Activated Sludge Process Control.
W86-03727 5D

Computerization: Can It Work for You,
W86-03731 5D

Computer as a Tool for Activated Sludge,
W86-03732 5D

CONDENSATES
Stripping Kraft Foul Condensates with Waste Gases,
W86-03624 5D

CONDUCTIVITY
Alkalinity Feed Forward Control of Alum Addition in Wastewater Treatment,
W86-03666 5D

CONFERENCES
Proceedings of Workshop on Algal Management and Control,
W86-03483 4A

CONJUNCTIVE USE
Optimization of Conjunctive Use of Groundwater and Surface Water Resources in the Vaal Basin,
W86-03573 4B

CONNECTICUT
Chemical and Physical Properties of Connecticut Lakes,
W86-03438 2H

CONSERVATION
Planning Approach for Improved Management of Illinois Streams for Recreation and Conservation,
W86-03452 5G

CONSUMPTIVE USE
Study of Anthropogenic Influence on Water Quality in Some Rivers of the Baltic Sea Basin,
W86-03779 5B

CONTROL SYSTEMS
Alkalinity Feed Forward Control of Alum Addition in Wastewater Treatment,
W86-03666 5D

COOLING
Ice Forming Experiment,
W86-03641 2C

COPPER SULFATE
Selective Algicides,
W86-03485 5G

COST ANALYSIS
Pollution Control: The Hidden Profit Centre,
W86-03671 5D

COST-BENEFIT ANALYSIS
Impact of Nitrogen Fertilizer Application on the Nitrate Concentration in Groundwater: Cost-Benefit Analysis Considerations,
W86-03652 5G

COVER CROPS
Mulch Requirements for Erosion Control with the No-Till System in the Tropics: A Review,
W86-03600 4D

CRYOLOGY
Recent Secular Variations of Snow and Sea Ice Cover,
W86-03695 2C

CRYSTAL GROWTH
Investigations of Large Scale Storm Systems: Final Report,
W86-03647 2B

CRYSTALLINE ROCKS
Studies on Groundwater Transport in Fractured Crystalline Rock under Controlled Conditions Using Nonradioactive Tracers,
W86-03497 2F

CULTIVATION
Mulch Requirements for Erosion Control with the No-Till System in the Tropics: A Review,
W86-03600 4D

Runoff, Erosion and Soil Fertility Restoration on the Mossi Plateau (Central Upper Volta),
W86-03601 4D

CULTURAL RESOURCES INVENTORY
Dirty Devil Project: Class II Cultral Resources Inventory in Central Utah,
W86-03518 6G

CURRENT METERS
Currents in San Pablo Bay,
W86-03449 2L

CYANIDE
Removal of Various Toxic Heavy Metals and Cyanide from Water by Membrane Processes,
W86-03532 5D

CYANOBACTERIA
Utilization of Bacteria in Managing Cyanobacterial Populations: A Review and Update,
W86-03493 2H

CYANOPHYTA
Cyanophages: Are They Potential Biological Control Agents of Nuisance Blue-Green Algae,
W86-03492 2H

CYCLING NUTRIENTS
Large-Scale Operations Management Test of Use of the White Amur for Control of Problem Aquatic Plants, Report 2: First Year Poststocking Results,
W86-03454 2H

Conditions and Frequency of Sampling for Elucidations of Transport Mechanisms and Element Budgets in Upland Drainage Basins,
W86-03770 7A

Measurement of Nutrient Concentrations in Sediment Pore Water Collected by a Dialysis Sampler,
W86-03877 5A

CYCLONES
Investigations of Large Scale Storm Systems: Final Report,
W86-03647 2B

DAILY HYDROGRAPHS
Physico-Chemical Characteristics of Surface Waters and Hydrological Behavior of a Small Granitic Basin (Vosges Massif, France): Annual and Daily Variations,
W86-03775 5B

DAM EFFECTS
Impounded Rivers: Perspectives for Ecological Management,
W86-03516 6G

DATA ACQUISITION
Continuous Monitoring of Rainfall, Streamflow and Suspended Sediment Concentration in Semi-arid Environments,
W86-03591 7B

Inventory of Canadian Glaciers: Procedures, Techniques, Progress and Applications,
W86-03677 2C

Design of a Hydrochemical Data Collection Programme,
W86-03767 7A

Hydrometeorological Data Acquisition: Innovative, High-Resolution Programmable Instrumentation for Stormwater Management,
W86-03829 7B

DATA AQUISITION
Low Cost Hydrological Data Collection,
W86-03581 7B

DATA COLLECTION
Low Cost Hydrological Data Collection,
W86-03581 7B

DATA COLLECTIONS
Directory of Member Organizations of the National Water Data Exchange (NAWDEX),
W86-03557 10D

Hydrogeological Data Collection, Storage, Retrieval and Water Law in Botswana,
W86-03580 7C

DATA INTERPRETATION
Use of Log-Normal Statistics in Environmental Monitoring,
W86-03531 7C

Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium.
W86-03753 5B

Data Collection for Hydrochemical Balances: Theoretical Aspects,
W86-03766 2A

Design of a Hydrochemical Data Collection Programme,
W86-03767 7A

Reliability of Information in Hydrogeochemical Investigations,
W86-03769 7A

DATA STORAGE AND RETRIEVAL
Directory of Member Organizations of the National Water Data Exchange (NAWDEX),
W86-03557 10D

Hydrogeological Data Collection, Storage, Retrieval and Water Law in Botswana,
W86-03580 7C

DECISION MAKING
Design of a Hydrochemical Data Collection Programme,
W86-03767 7A

DEEP WATER
Deep-Water Blowout Trajectory Models for the Lancaster Sound Region,
W86-03638 5B

DELAWARE
WATER 2000: Conservation Program.
W86-03445 3D

DELTAS
Reversal of Coastal Erosion by Rapid Sedimentation: The Atchafalaya Delta (South-Central Louisiana),
W86-03865 2J

DENITRIFICATION
Evaluation of Biological Nitrification-Denitrification at Penticton, British Columbia,
W86-03619 5D

Combined Nitrogen and Phosphorus Removal from Wastewaters,
W86-03844 5D

DEPOSITION
Reversal of Coastal Erosion by Rapid Sedimentation: The Atchafalaya Delta (South-Central Louisiana),
W86-03865 2J

DESALINATION APPARATUS
Preparation of Ion-Exchange Membranes with Extremely Low Areal Resistances,
W86-03615 3A

DESIGN CRITERIA
Revetment Stability Study, Fort Fisher State Historic Site, North Carolina: Hydraulic Model Investigation,
W86-03479 8A

Nonlinear Programming Model of a Wastewater Treatment System: Sensitivity Analysis and a Robustness Constraint,
W86-03511 5D

Procedure for Developing Biological Input for the Design, Location, or Modification of Water-Intake Structures,
W86-03519 8I

Evaluation of Biological Nitrification-Denitrification at Penticton, British Columbia,
W86-03619 5D

Polysar Biological Oxidation Treatment Plant,
W86-03660 5D

Functional Design of Activated Sludge Processes,
W86-03670 5D

Procedures and Practices in Activated Sludge Process Control.
W86-03727 5D

DESIGN CRITERIA

Design of Activated Sludge Facilities for Operating and Maintainability,
W86-03734 5D

Good Process Control: Planning and Implementation,
W86-03735 5D

DESIGN STORMS
Preparing a Design Storm,
W86-03833 2A

DEWATERING
Use of Aquatic Macrophytes for Sludge Treatment,
W86-03669 5D

Theoretical Considerations of Gravity Dewatering of Dredged Material Through the Bottom of a Containment Area,
W86-03870 5D

Rapid Dewatering Test of Dredged Material In Situ,
W86-03871 5D

Mechanical Dewatering of Dredged Slurries,
W86-03872 5D

Theoretical Consideration of Pond and Spillwater Treatment Design,
W86-03876 5G

DIATOMS
Extracellular Metabolite Involvement in Plankton Community Structure,
W86-03491 2H

DIGESTED SLUDGE
Use of Aquatic Macrophytes for Sludge Treatment,
W86-03669 5D

DIGESTION
Final Environmental Impact Statement for Sludge Disposal for the Des Moines Integrated Community Area,
W86-03635 5E

DIKES
Evaluation of Community Information Indices for Mississippi River Fisheries,
W86-03499 7C

Evaluating Changes in Dike Field Fishes with Community Information Indices,
W86-03628 7A

DISCHARGE HYDROGRAPHS
Physico-Chemical Characteristics of Surface Waters and Hydrological Behavior of a Small Granitic Basin (Vosges Massif, France): Annual and Daily Variations,
W86-03775 5B

DISINFECTION
Rational Approaches in the Analysis of Chemical Disinfection Kinetics,
W86-03538 5D

Biological Evaluation of Methods for the Determination of Free Available Chlorine,
W86-03539 5A

Chlorine Dioxide Chemistry: Generation and Residual Analysis,
W86-03540 5F

Reduction of Trihalomethane Production with Optimal Disinfection Through Alternative Disinfection Systems,
W86-03542 5F

Insoluble Polymeric Contact Disinfectants: An Alternative Approach to Water Disinfection,
W86-03543 5F

DISPERSANTS
Fate of Oil and Dispersant Mixtures in Freshwater,
W86-03637 5B

DISPERSION
Time of Travel and Dispersion of Solutes in a 36.4-Mile Reach of the North Platte River Downstream from Casper, Wyoming,
W86-03559 2E

DISSOLVED AIR FLOTATION
Dissolved Air Flotation for Primary and Secondary Clarification,
W86-03611 5D

DISSOLVED OXYGEN
Boundary Conditions of Sediment Surfaces Viewed from DO Behavior,
W86-03467 2H

Respiratory Gas Content (O2 and CO2) and Ionic Composition of River Water in the Plain of Alsace (Eastern France),
W86-03763 2F

Continuous DO Response Predicted Using CSPSS Is Verified for Springfield, Missouri,
W86-03826 5B

DISSOLVED SOLIDS
Geochemistry and Geohydrology of the West Decker and Big Sky Coal-Mining Areas, Southeastern Montana,
W86-03545 2K

Study of the Hydrochemical Regime and Its Long-Term Variations in the Case of Some Rivers in U.S.S.R.,
W86-03778 2K

DIURNAL DISTRIBUTION
Respiratory Gas Content (O2 and CO2) and Ionic Composition of River Water in the Plain of Alsace (Eastern France),
W86-03763 2F

DOCUMENTATION
Military Hydrology; Report 3: A Review of Army Doctrine on Military Hydrology,
W86-03456 10F

DOLOMITE
Hydrochemistry of Springs from Dolomite Reefs in the Southern Alps of Northern Italy,
W86-03765 2K

DOMESTIC WASTES
Application of Biological Batch Reactor Technology in Wastewater Treatment,
W86-03665 5D

Publications of the Water Research Institute, 58.
W86-03842 5D

Rapid Filtration as a Supplementary Treatment of Domestic Sewage,
W86-03843 5D

DRAINAGE
Changes in Ground-Water Chemical Composition in Drained Peat Bogs in Connection with Environmental Protection Measures,
W86-03764 2F

DRAINAGE AREA
Probable Maximum Precipitation Estimates for the Drainage Above Dewey Dam, Johns Creek, Kentucky,
W86-03503 2B

DRAINAGE EFFECTS
Effects of Regional Water Management on N-Pollution in Areas with Intensive Agriculture,
W86-03650 5G

DRAINAGE PATTERNS
Chimney Hill Off-Site Drainage Study,
W86-03835 2A

DREDGING
Management of Bottom Sediments Containing Toxic Sustances: Proceedings of the 8th U.S./Japan Experts Meeting,
W86-03461 5G

Dredging and Management Problems in Lake Suwa,
W86-03462 5G

Removal of Bottom Sediments in Osaka Port by the Pneuma Pump Dredge 'Shunkai',
W86-03463 5G

Capping of Dredged Material Disposal Management for New York Harbor,
W86-03464 5G

Restoration Study of Dredging in Lake Ksaumigaura,
W86-03468 5G

Specialized Dredges Designed for Bottom Sediment Dredging,
W86-03469 5G

Performance Tests of Pneuma Dredge Pump,
W86-03470 5G

Bottom Sediment Dredge 'Clean Up' - Principle and Results -,
W86-03471 5G

Overview of Corps Research Program on Dredging Contaminated Sediments,
W86-03472 5G

Field Dredging Test of Soft Mud Layer by a Front-Open Type Drag Head,
W86-03473 5G

Overview of a Dredging Demonstration in Contaminated Material, James River, Virginia,
W86-03474 5G

Eco-Kinetic Model for the Accumulation of PCB in Marine Fishes,
W86-03475 5B

Aquaculture in Dredged Material Containment Areas: Proceedings,
W86-03704 2H

Site Description of Dredged Material Containment Areas: An Overview of Physical, Chemical, Biological Features,
W86-03705 2H

Pond Management: Polyculture vs. Monoculture,
W86-03707 2H

Pond Management: Water Quality Criteria and Control,
W86-03708 5G

Health and Disease Control for Aquatic Animals in Dredged Material Containment Sites,
W86-03709 5C

Pond Design and Management for Coastal Aquaculture,
W86-03710 2H

Mariculture in Old Rice Field Impoundments: An Analogy for Dredged Material Containment Areas,
W86-03711 2L

Selection Criteria and Procedures for Establishing Mariculture Facilities in Existing Containment Sites,
W86-03712 5C

Design Criteria for Aquaculture Ponds on Dredged Material,
W86-03713 8I

Aquaculture and Dredged Material Containment Sites: Significance of Contaminated Sediments,
W86-03714 5B

Legal Environment of a Containment Site: Laws Governing the Acquisition, Maintenance, and Operation of Dredged Material Disposal Sites,
W86-03715 6E

Wetland Loss Directly Associated with Canal Dredging in the Louisiana Coastal Zone,
W86-03854 6G

Canals and Wetland Erosion Rates in Coastal Louisiana,
W86-03855 6G

Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/Japan Experts Meeting.
W86-03867 5G

Theoretical Considerations of Gravity Dewatering of Dredged Material Through the Bottom of a Containment Area,
W86-03870 5D

Rapid Dewatering Test of Dredged Material In Situ,
W86-03871 5D

Mechanical Dewatering of Dredged Slurries,
W86-03872 5D

Dispersion of Sediment Resuspension Caused by Dredge Operation,
W86-03873 5B

Anti-Turbidity Overflow System (ATOS) Used for Reducing the Dispersion of Fine Sediments from a Dredge Plane,
W86-03874 5E

Theoretical Consideration of Pond and Spillwater Treatment Design,
W86-03876 5G

Alternatives to Open Water Disposal of Contaminated Dredged Material,
W86-03879 5E

Rehabilitation of Estuaries in Tsu-Matsusaka Harbor,
W86-03880 5G

Subsurface Investigation for Dredging Projects,
W86-03881 7A

Beneficial Uses of Dredged Material: Aquaculture in Dredged Material Containment Areas,
W86-03882 5E

DRILLERS LOGS

Geologic and Hydrologic Data from a Test-Drilling Program in the High Plains Areas of South Dakota, 1979-1980,
W86-03558 2F

DRILLING SAMPLES

Geologic and Hydrologic Data from a Test-Drilling Program in the High Plains Areas of South Dakota, 1979-1980,
W86-03558 2F

DRINKING WATER

Determination of Polycyclic Aromatic Hydrocarbons in Industrial Discharges and Other Aqueous Effluents,
W86-03506 5A

Giardiasis in Washington State,
W86-03507 5C

Possibilities of Controlling Nitrate Concentrations in Drinking Water,
W86-03653 5G

Possibilities of Water Management for Protecting and Treating Drinking Water Resources in Case of Nitrate Pollution,
W86-03654 5G

Modelling Nitrate Pollution in Water Resource Systems: The Thames Nitrate Project,
W86-03657 5G

DROUGHT EFFECTS

Drought-Related Impacts on Municipal and Major Self-Supplied Industrial Water Withdrawals in Tennessee, (Part A and Part B),
W86-03560 6D

DYE RELEASES

Time of Travel and Dispersion of Solutes in a 36.4-Mile Reach of the North Platte River Downstream from Casper, Wyoming,
W86-03559 2E

EARTH-WATER INTERFACES

Simulation of Physicochemical Interactions in a Water-Rock System in Assessing Ground-Water Quality,
W86-03759 2K

Some Implication of the Role of Kinetics in Enhancing Element Transport,
W86-03760 2K

ECOLOGICAL EFFECTS

Effect of Soil on the Mutagenic Properties of Waste Water,
W86-03502 5C

Impounded Rivers: Perspectives for Ecological Management,
W86-03516 6G

Ecological History of the Upper Mississippi River,
W86-03738 6G

Role of Contaminants in the Decline of the Illinois River: Implications for the Upper Mississippi,
W86-03739 6G

Aerobic Transformation of Nitrogenous Substances in a Freshwater Ecosystem,
W86-03782 5C

ECOLOGY

Ecological Solutions to Environmental Management Concerns in the Pinelands National Reserve: Proceedins of a Conference,
W86-03616 2L

ECONOMIC ANALYSIS

Integrated Physical-Economic Systems Analysis of Irrigated Agriculture,
W86-03658 5G

ECONOMIC ASPECTS

Significance and Limitations of Environmental Compartmentalization Models in the Control of New Chemicals Based on the Organization for Economic Cooperation and Development Minimum Premarketing Set of Data,
W86-03423 5G

Levee Policy for the National Flood Insurance Program,
W86-03622 6F

Design of a Hydrochemical Data Collection Programme,
W86-03767 7A

Wetland Losses and Coastal Fisheries: An Enigmatic and Economically Significant Dependency,
W86-03859 2L

Economic and Cultural Consequences of Land Loss in Louisiana,
W86-03861 6G

ECONOMIC FEASIBILITY

Comparison of Stirred Suspension and Fixed Film Anaerobic Digestion Systems,
W86-03668 5D

ECOSYSTEMS

Induced Change and Its Impact on Aquatic Community Quality in the Sangamon River Basin of Illinois,
W86-03453 5G

Aerobic Transformation of Nitrogenous Substances in a Freshwater Ecosystem,
W86-03782 5C

EDUCATION

Polysar Biological Oxidation Treatment Plant,
W86-03660 5D

EFFLUENT LIMITATIONS

Establishment of an Ammonia Effluent Limitation for the Twin Cities Metro Plant,
W86-03748 5B

EFFLUENTS

Status Report on Compliance with the Chlor-Alkali Mercury Liquid Effluent Regulations 1980-81,
W86-03633 5E

Functional Design of Activated Sludge Processes,
W86-03670 5D

EGRETS

Polychlorinated Biphenyls and Organochlorine Insecticides in Great Blue Heron and Great Egret Eggs from the Upper Mississippi River,
W86-03747 5B

ELECTRICAL EQUIPMENT

Solar Powered Groundwater Pumping for Medium Heads,
W86-03583 8C

ELECTRICAL STUDIES

Electric Logs for Groundwater Exploration in the Niger Delta.
W86-03570 2F

ELECTRODIALYSIS

Use of Different Physical Separation Techniques for Trace Element Speciation Studies in Natural Waters,
W86-03771 2K

ELECTROPHORESIS

Use of Different Physical Separation Techniques for Trace Element Speciation Studies in Natural Waters,
W86-03771 2K

ENTRAINMENT

Procedure for Developing Biological Input for the Design, Location, or Modification of Water-Intake Structures,
W86-03519 8I

ENVIRONMENT

Ecological Solutions to Environmental Management Concerns in the Pinelands National Reserve: Proceedins of a Conference,
W86-03616 2L

ENVIRONMENTAL EFFECTS

Human Adaptation Along the Columbia River 4700-1600 BP.: A Report of Test Excavation at River Mile 590, North Central Washington,
W86-03460 6E

Impounded Rivers: Perspectives for Ecological Management,
W86-03516 6G

Sediment Yield Estimation and the Design of Sediment Control Structures in Rural Africa,
W86-03595 4D

ENVIRONMENTAL EFFECTS

Onshore Impacts of Offshore Hydrocarbon Development: Annotated Bibliography,
W86-03620 5C

Final Environmental Impact Statement: Regional Flood Control Tonawanda Creek, Genesee County, New York,
W86-03626 4A

Evaluating Changes in Dike Field Fishes with Community Information Indices,
W86-03628 7A

Effects of Fluctuating Reservoir Water Levels on Fisheries, Wildlife, and Vegetation: Summary of a Workshop, 24-26 February 1981,
W86-03642 6G

Potential Biological Impacts of Navigation Traffic,
W86-03645 6G

Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium.
W86-03737 6G

Ecological History of the Upper Mississippi River,
W86-03738 6G

Role of Contaminants in the Decline of the Illinois River: Implications for the Upper Mississippi,
W86-03739 6G

Sediments of the Upper Mississippi River: Their Sources, Distribution, and Characteristics,
W86-03740 2J

Recent Rates of Sedimentation in the Mississippi River,
W86-03741 2J

Investigation of Effects of Navigation Traffic Activities on Hydrologic, Hydraulic, and Geomorphic Characteristics in the Upper Mississippi River System,
W86-03750 5B

Problems on the Upper Mississippi River and Its Tributaries: Need for a Long-Term Resource Monitoring Program,
W86-03751 7A

Contaminants in the Upper Mississippi River: Summary and Conclusions,
W86-03752 6G

Effects of Wetland Deterioration on the Fish and Wildlife Resources of Coastal Louisiana,
W86-03857 2L

ENVIRONMENTAL IMPACT STATEMENT

Final Environmental Impact Statement for Sludge Disposal for the Des Moines Integrated Community Area,
W86-03635 5E

ENVIRONMENTAL PROTECTION

Canadian Inland Waters: Coastal Environments and the Cleanup of Oil Spills,
W86-03621 5G

Changes in Ground-Water Chemical Composition in Drained Peat Bogs in Connection with Environmental Protection Measures,
W86-03764 2F

ENVIRONMENTAL TRACERS

Results of a Solute Transport Experiment at Uvas Creek, September 1972,
W86-03556 2E

EROSION

Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium,
W86-03562 2F

Sediment Yields of African Rivers,
W86-03584 2J

Rates of Erosion and Sediment Yield in the African Environment,
W86-03585 2J

Appraisal of Sediment Transport Measurement in Ghanaian Rivers,
W86-03586 7A

Suspended Sediment Transport Measurement in Lesotho,
W86-03587 2J

Gully Erosion in the Agulu-Nanka Region of Anambra State, Nigeria,
W86-03589 2J

Remote Sensing Applications in African Erosion and Sedimentation Studies,
W86-03592 7B

Some Methods for Evaluating Soil Erosion Risk,
W86-03593 2J

Sediment Yield Estimation and the Design of Sediment Control Structures in Rural Africa,
W86-03595 4D

Sheet Erosion from Arable Lands in Zimbabwe: Prediction and Control,
W86-03596 2J

Approach to Testing the USLE Factor Values in Kenya,
W86-03597 2J

Evaluation of Factors Influencing Water Erosion in West Africa Using Rainfall Simulation,
W86-03598 2J

Testing the Applicability of a Soil Erodibility Nomogram for Some Tropical Soils,
W86-03599 2J

Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium.
W86-03737 6G

Sediments of the Upper Mississippi River: Their Sources, Distribution, and Characteristics,
W86-03740 2J

Erosion of Agricultural Land - A Growing Water Quality Problem in Rural Areas,
W86-03780 5B

Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options.
W86-03850 2J

Assessment of Geological and Human Factors Responsible for Louisiana Coastal Barrier Erosion,
W86-03852 2J

Some Consequences of Wetland Modification to Louisiana's Fisheries,
W86-03858 2L

Wetland Losses and Coastal Fisheries: An Enigmatic and Economically Significant Dependency,
W86-03859 2L

Legal Implications of Coastal Erosion in Louisiana,
W86-03860 6E

Economic and Cultural Consequences of Land Loss in Louisiana,
W86-03861 6G

EROSION CONTROL

Instrumentation and Methods Evaluations for Shallow Land Burial of Waste Materials: Water Erosion,
W86-03510 5E

Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium,
W86-03562 2F

Veld Burning and Sediment Yield from Small Drainage Basins,
W86-03588 4D

Gully Erosion in the Agulu-Nanka Region of Anambra State, Nigeria,
W86-03589 2J

Measurement of Soil Loss from Experimental Basins in Malawi,
W86-03590 2J

Sediment Yield Estimation and the Design of Sediment Control Structures in Rural Africa,
W86-03595 4D

Sheet Erosion from Arable Lands in Zimbabwe: Prediction and Control,
W86-03596 2J

Mulch Requirements for Erosion Control with the No-Till System in the Tropics: A Review,
W86-03600 4D

Runoff, Erosion and Soil Fertility Restoration on the Mossi Plateau (Central Upper Volta),
W86-03601 4D

Surface Erosion and Sediment Control at Open-Cast Mines in Southern Africa,
W86-03602 4D

Indigenous Soil Conservation Studies in Sierra Leone,
W86-03603 4D

Sand Dune Vegetation and Stabilization in Louisiana,
W86-03864 2J

ERROR ANALYSIS

Data Collection for Hydrochemical Balances: Theoretical Aspects,
W86-03766 2A

Assessment of the Measurement Uncertainty in the Estimation of Stream Reaeration Rate Coefficients Using Direct Tracer Techniques,
W86-03824 5A

ERRORS

Reliability of Information in Hydrogeochemical Investigations,
W86-03769 7A

ESTUARIES

Verification of the Chesapeake Bay Model: Chesapeake Bay Hydraulic Model Investigation,
W86-03459 2L

Simulation of Estuarine Silt Transport According to Storm Water Runoff,
W86-03465 2J

User's Manual for EXPLORE-I: A River Basin Water Quality Model, Hydraulic Module Only,
W86-03646 2A

Geochemical Studies in the Drainage Basin of the Rio Vouga (Portugal). I. General Hydrogeochemistry from Its Origin to the Ria de Aveiro,
W86-03776 2K

EUTROPHIC LAKES

Chemical and Physical Properties of Connecticut Lakes,
W86-03438 2H

EUTROPHICATION
Phytoplankton Effects of Reservoir Use,
W86-03722 5G

Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/Japan Experts Meeting.
W86-03867 5G

Aeration Effects on Marine Eutrophication,
W86-03868 5G

EVALUATION
Evaluation of Oil Skimmers and Pumps,
W86-03625 5G

EVAPORATION
Regional Water Balance in the Mountainous Arctic and Its Application for Water-Resource Planning,
W86-03849 2D

EVAPOTRANSPIRATION
Hydrochemical Processes in Groundwater Discharge Areas,
W86-03762 2F

Hydrochemical Budgeting in Studies of Ground-Water Renewability in Areas of Glacial Formation Systems,
W86-03783 2F

EXPLORATION
African Groundwater Development-The Challenges for Hydrogeological Science,
W86-03563 2F

Groundwater Resources in Tropical African Regoliths,
W86-03564 2F

Character of Fractured Rock Aquifers in Eastern Botswana,
W86-03565 2F

Some Critical Issues with Monitoring Crystalline Rock Aquifers for Groundwater Management in Rural Areas,
W86-03567 2F

Characteristics of the Weathered Basement Aquifer in Malawi in Relation to Rural Water Supplies,
W86-03568 2F

Electric Logs for Groundwater Exploration in the Niger Delta.
W86-03570 2F

Isotope Studies as a Final Stage in Groundwater Investigations on the African Shield,
W86-03574 2F

EXTRAN
Improved Surcharge Computation, in EXTRAN,
W86-03832 3A

FALLOUT
Atmospheric Pollution in Relation to Storm Water Quality Modelling: Literature Review for an Industrial City,
W86-03838 5B

FATE OF POLLUTANTS
Predictive Fate Models: Their Role in the U.S. Environmental Protection Agency's Water Program,
W86-03421 5B

Evaluative Model for Estimating Environmental Fate,
W86-03424 5B

Fate and Transport Modeling for Toxic Substances,
W86-03425 5B

Simplified Model of the Fate of Partitioning Chemicals in Lakes and Streams,
W86-03426 5B

Hydrologic Transport Modeling,
W86-03427 5B

Modeling Chemical Reactions and Transport in Groundwater Systems: A Review,
W86-03428 5B

Complex Effluent Fate Modeling,
W86-03429 5B

Testing Models of the Fate of Chemicals in Aquatic Environments,
W86-03430 5B

Field Validation and Error Analysis of Chemical Fate Models,
W86-03431 5B

Field Validation of Exposure Analysis Modeling System (EXAMS) in a Flowing Stream,
W86-03432 5B

Assessment of Transport and Fate of Toxic Materials in an Experimental Stream Ecosystem,
W86-03433 5B

Legal Validation of Environmental Fate Models,
W86-03434 5G

Management of Bottom Sediments Containing Toxic Sustances: Proceedings of the 8th U.S./Japan Experts Meeting,
W86-03461 5G

Studies on Analytical Method of Acrylamide Monomer and Accumulation into Fish,
W86-03466 5B

Eco-Kinetic Model for the Accumulation of PCB in Marine Fishes,
W86-03475 5B

Comparison of Methods for Estimating Nutrient Release from Lake Sediments,
W86-03477 5B

Transport of Contaminants from Energy Process Waste Leachates through Subsurface Soils and Soil Components Laboratory Experiments,
W86-03500 5B

Giardiasis in Washington State,
W86-03507 5C

Determination of Carbohydrates and Primary Amines in River Water,
W86-03524 5A

Ultraviolet Multiwavelength Absorbance Measurements for Monitoring Trace Organics in Water,
W86-03525 5A

Pollution in Swimming Pool Water,
W86-03544 5B

Canadian Inland Waters: Coastal Environments and the Cleanup of Oil Spills,
W86-03621 5G

Literature Survey of Reservoir Contaminant Problems,
W86-03623 5B

Consequence Assessment of Hydrological Communications through Borehole Plugs,
W86-03629 5G

User's Manual for the Instream Sediment-Contaminant Transport Model SERATRA,
W86-03630 5B

Final Environmental Impact Statement for Sludge Disposal for the Des Moines Integrated Community Area,
W86-03635 5E

Fate of Oil and Dispersant Mixtures in Freshwater,
W86-03637 5B

Evaluation of Selected One-Dimensional Stream Water-Quality Models with Field Data,
W86-03644 5B

Mathematical Model, SERATRA, for Sediment-Contaminant Transport in Rivers and Its Application to Pesticide Transport in Four Mile and Wolf Creeks in Iowa,
W86-03648 5B

Hydrogeological Aspects of Groundwater Nitrification,
W86-03651 5B

Impact of Nitrogen Fertilizer Application on the Nitrate Concentration in Groundwater: Cost-Benefit Analysis Considerations,
W86-03652 5G

Aquaculture and Dredged Material Containment Sites: Significance of Contaminated Sediments,
W86-03714 5B

Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium.
W86-03737 6G

Distribution and Enrichment of Trace Metals (Cd, Cr, Cu, Ni, Pb, Zn) in Bottom Sediments of Navigation Pools 4 (Lake Pepin), 5 and 9 of the Upper Mississippi River,
W86-03742 5B

Longitudinal Distribution of Trace Elements (As, Cd, Cr, Hg, Pb, and Se) in Fishes and Sediments in the Upper Mississippi River,
W86-03743 5B

Heavy Metal Accumulation in Selected Sessile Components of Fountain City Bay, Pool 5A, of the Upper Mississippi River,
W86-03744 5B

Trace Elements in the Water, Sediments, and Fish of the Upper Mississippi River, Twin Cities Metropolitan Area,
W86-03745 5B

Polychlorinated Biphenyls (PCBs) in Common Carp (Cyprinus carpio) of the Upper Mississippi River,
W86-03746 5B

Polychlorinated Biphenyls and Organochlorine Insecticides in Great Blue Heron and Great Egret Eggs from the Upper Mississippi River,
W86-03747 5B

Establishment of an Ammonia Effluent Limitation for the Twin Cities Metro Plant,
W86-03748 5B

Water Chemistry at Selected Sites on Pools 7 and 8 of the Upper Mississippi River: A Ten-Year Survey,
W86-03749 5B

Investigation of Effects of Navigation Traffic Activities on Hydrologic, Hydraulic, and Geomorphic Characteristics in the Upper Mississippi River System,
W86-03750 5B

Contaminants in the Upper Mississippi River: Summary and Conclusions,
W86-03752 6G

Lead and Cadmium in Precipitation in the Essex Region of Southwestern Ontario,
W86-03772 5B

FATE OF POLLUTANTS

Hydrochemical Budgets of Some Dutch Woodland Soils with High Inputs of Atmospheric Acid Deposition: Mobilization of Aluminum,
W86-03774 5B

Physico-Chemical Characteristics of Surface Waters and Hydrological Behavior of a Small Granitic Basin (Vosges Massif, France): Annual and Daily Variations,
W86-03775 5B

Water Quality and Water Pollution Problems on the Indian Sub-Continent,
W86-03781 5B

Model Experimental Study of Hydrochemical Processes in the Saturated Zone,
W86-03785 2K

FEASIBILITY STUDIES

Investigation of the Feasibility of Secondary Recovery of Ground Water from the Ogallala Aquifer: A Report to the Sixty-Eighth Legislature.
W86-03442 3B

FERMENTATION

Anaerobic Pretreatment Facility Also Provides Sludge Disposal Capability and Source of Renewable Energy for Food Processor,
W86-03661 5D

FERTILIZERS

Nonpoint Nitrate Pollution of Municipal Water Supply Sources: Issues of Analysis and Control,
W86-03649 5G

FILTER RATES

Rapid Filtration as a Supplementary Treatment of Domestic Sewage,
W86-03843 5D

FILTRATION

Demonstration of a Cross-Flow Microfiltration System from the Removal of Toxic Heavy Metals from Battery Manufacturing Wastewater Effluents,
W86-03533 5D

Filtrable Solids as a Design Parameter for Wastewater Treatment Processes,
W86-03662 5D

Publications of the Water Research Institute, 58.
W86-03842 5D

Rapid Filtration as a Supplementary Treatment of Domestic Sewage,
W86-03843 5D

FINITE DIFFERENCE METHODS

Mathematical Analysis of Groundwater Resources,
W86-03478 2F

FINITE ELEMENT METHOD

User's Manual for the Instream Sediment-Contaminant Transport Model SERATRA,
W86-03630 5B

FIRN

Problems and Results of Studies of Mountain Glaciers in the Soviet Union,
W86-03686 2C

FISH

Studies on Analytical Method of Acrylamide Monomer and Accumulation into Fish,
W86-03466 5B

Eco-Kinetic Model for the Accumulation of PCB in Marine Fishes,
W86-03475 5B

Accumulation of Acrylamide into Fish,
W86-03878 5C

FISH BEHAVIOR

Procedure for Developing Biological Input for the Design, Location, or Modification of Water-Intake Structures,
W86-03519 8I

FISH DISEASES

Health and Disease Control for Aquatic Animals in Dredged Material Containment Sites,
W86-03709 5C

FISH FARMING

Aquaculture in Dredged Material Containment Areas: Proceedings,
W86-03704 2H

Site Description of Dredged Material Containment Areas: An Overview of Physical, Chemical, Biological Features,
W86-03705 2H

Review of Species Suitable for Containment Site Culture (Fresh Water),
W86-03706 2H

Pond Management: Polyculture vs. Monoculture,
W86-03707 2H

Pond Management: Water Quality Criteria and Control,
W86-03708 5G

Health and Disease Control for Aquatic Animals in Dredged Material Containment Sites,
W86-03709 5C

Pond Design and Management for Coastal Aquaculture,
W86-03710 2H

Mariculture in Old Rice Field Impoundments: An Analogy for Dredged Material Containment Areas,
W86-03711 2L

Design Criteria for Aquaculture Ponds on Dredged Material,
W86-03713 8I

FISH LADDERS

Procedure for Developing Biological Input for the Design, Location, or Modification of Water-Intake Structures,
W86-03519 8I

FISH MANAGEMENT

Effects of Fluctuating Reservoir Water Levels on Fisheries, Wildlife, and Vegetation: Summary of a Workshop, 24-26 February 1981,
W86-03642 6G

FISH PONDS

Aquaculture in Dredged Material Containment Areas: Proceedings,
W86-03704 2H

Site Description of Dredged Material Containment Areas: An Overview of Physical, Chemical, Biological Features,
W86-03705 2H

Review of Species Suitable for Containment Site Culture (Fresh Water),
W86-03706 2H

Pond Management: Polyculture vs. Monoculture,
W86-03707 2H

Pond Management: Water Quality Criteria and Control,
W86-03708 5G

Health and Disease Control for Aquatic Animals in Dredged Material Containment Sites,
W86-03709 5C

Pond Design and Management for Coastal Aquaculture,
W86-03710 2H

Mariculture in Old Rice Field Impoundments: An Analogy for Dredged Material Containment Areas,
W86-03711 2L

Design Criteria for Aquaculture Ponds on Dredged Material,
W86-03713 8I

FISH POPULATIONS

Evaluation of Community Information Indices for Mississippi River Fisheries,
W86-03499 7C

Distribution and Relative Abundance of Fishes in Wisconsin; V: Grant and Platte, Coon and Bad Axe, and LaCrosse River Basins,
W86-03501 6G

Evaluating Changes in Dike Field Fishes with Community Information Indices,
W86-03628 7A

FISHERIES

Some Consequences of Wetland Modification to Louisiana's Fisheries,
W86-03858 2L

Wetland Losses and Coastal Fisheries: An Enigmatic and Economically Significant Dependency,
W86-03859 2L

FISSURE WATER

Surface and Groundwater Mixing and Identification of Local Recharge-Discharge Zones from Seasonal Fluctuations of Oxygen-18 in Groundwater in Fissured Rock,
W86-03790 2F

FLOATING ICE

West Greenland Outlet Glaciers: An Inventory of the Major Iceberg Producers,
W86-03679 2C

FLOCCULATION

Computation of Fractional Removal of Discrete and Flocculant Particles in Settling Basins,
W86-03667 5D

Post-Precipitation in Wastewater Treatment,
W86-03845 5D

FLOOD CONTROL

Levee Policy for the National Flood Insurance Program,
W86-03622 6F

FLOOD COTROL

Final Environmental Impact Statement: Regional Flood Control Tonawanda Creek, Genesee County, New York,
W86-03626 4A

FLOOD DAMAGE

Levee Policy for the National Flood Insurance Program,
W86-03622 6F

FLOOD FREQUENCY

Evaluating the Use of Depth-Frequency Equations for Enforcing Local Floodplain Regulations,
W86-03450 2E

FLOOD PLAIN MANAGEMENT

Evaluating the Use of Depth-Frequency Equations for Enforcing Local Floodplain Regulations,
W86-03450 2E

Levee Policy for the National Flood Insurance Program,
W86-03622 6F

Impacts of Flooding Regime Modification on Wildlife Habitats of Bottomland Hardwood Forests in the Lower Mississippi Valley,
W86-03634 6G

FLOOD PLAINS
Evaluating the Use of Depth-Frequency Equations for Enforcing Local Floodplain Regulations,
W86-03450 2E

FLOOD RECURRENCE INTERVAL
Statistical Summaries of Streamflow Data in Oregon; Volume 1 Eastern Oregon,
W86-03550 2E

FLOODS
Floods of March 1982, Indiana, Michigan, and Ohio,
W86-03552 2E

Impacts of Flooding Regime Modification on Wildlife Habitats of Bottomland Hardwood Forests in the Lower Mississippi Valley,
W86-03634 6G

FLOODWATER
Hydrochemical Relationships Between Rainwater, Floods, Groundwater and Lithology in the Avedat Group on the Negev Highlands, Israel,
W86-03789 2A

FLORIDA
Evaluation of Future Base-Flow Water-Quality Conditions in the Hillsborough River, Florida,
W86-03546 5B

Chemical Quality of Landfill Leachate in Treatment Ponds and Migration of Leachate in the Surficial Aquifer, Pinellas County, Florida,
W86-03549 5B

Hydrogeologic Data from a Test Well at Kathryn Abbey Hanna Park, City of Jacksonville, Florida,
W86-03555 2F

FLORIDAN AQUIFER
Hydrogeologic Data from a Test Well at Kathryn Abbey Hanna Park, City of Jacksonville, Florida,
W86-03555 2F

FLOW AUGMENTATION
Streamflow Augmentation at Fosters Brook, Long Island, New York - A Hydraulic Feasibility Study,
W86-03551 4A

FLOW CHARACTERISTICS
Currents in San Pablo Bay,
W86-03449 2L

FLOW DURATION
Statistical Summaries of Streamflow Data in Oregon; Volume 1 Eastern Oregon,
W86-03550 2E

FLUIDIZED BED PROCESS
Pilot-Scale Assessment of the Biological Fludized Bed Process for Municipal Wastewater Treatment,
W86-03631 5D

FLUORESCENCE
Time of Travel and Dispersion of Solutes in a 36.4-Mile Reach of the North Platte River Downstream from Casper, Wyoming,
W86-03559 2E

DCMU-Enhanced Chlorophyll Fluorescence as an Indication of the Physiological Status of Reservoir Phytoplankton: An Initial Evaluation,
W86-03721 2H

FLUORIDES
Occurrence and Distribution of Fluoride in Groundwaters of Kenya,
W86-03569 2K

FLUSHING
Feasibility of Flushing Sediments through Reservoirs,
W86-03608 2J

FOOD CHAINS
Limits to the Control of Algal Populations by Grazing Zooplankton: The Environmental Theater and the Ecological Play,
W86-03489 5G

FOOD-PROCESSING WASTES
Anaerobic Pretreatment Facility Also Provides Sludge Disposal Capability and Source of Renewable Energy for Food Processor,
W86-03661 5D

Pollution Control: The Hidden Profit Centre,
W86-03671 5D

FOREST SOILS
Hydrochemical Budgets of Some Dutch Woodland Soils with High Inputs of Atmospheric Acid Deposition: Mobilization of Aluminum,
W86-03774 5B

FORESTS
Impacts of Flooding Regime Modification on Wildlife Habitats of Bottomland Hardwood Forests in the Lower Mississippi Valley,
W86-03634 6G

FORTRAN
Application Guide for Hydrological Simulation Program: FORTRAN (HSPF),
W86-03614 2A

Comparison of Soil Moisture Characteristics Predicted by the Arya-Paris Model with Laboratory-Measured Data,
W86-03636 2G

FOULING
Slime Growth on Fine Bubble Diffusers,
W86-03672 5D

FRACTURE PERMEABILITY
Studies on Groundwater Transport in Fractured Crystalline Rock under Controlled Conditions Using Nonradioactive Tracers,
W86-03497 2F

FUTURE PLANNING
Water 2000, Volume IX: Plan Management Summary,
W86-03435 6A

WATER 2000: Conservation Program.
W86-03445 3D

GAGES
Low Cost Hydrological Data Collection,
W86-03581 7B

GELS
Use of Different Physical Separation Techniques for Trace Element Speciation Studies in Natural Waters,
W86-03771 2K

GEOCHEMISTRY
Hydrochemical and Isotopic Content of Basalt Groundwaters Beneath the Hanford Site, Washington,
W86-03517 2K

Occurrence and Distribution of Fluoride in Groundwaters of Kenya,
W86-03569 2K

Role of Natural Organics on Water Interaction with Soil and Rock,
W86-03754 2K

Hydrogeochemical Evolution and Variability of Groundwater in Experimental Basins of S. W. Western Australia,
W86-03757 2F

Some Implication of the Role of Kinetics in Enhancing Element Transport,
W86-03760 2K

Hydrochemical Processes in Groundwater Discharge Areas,
W86-03762 2F

Reliability of Information in Hydrogeochemical Investigations,
W86-03769 7A

Mass-Balance Approach to the Understanding of Geochemical Processes in Aqueous Systems,
W86-03773 5B

Geochemical Studies in the Drainage Basin of the Rio Vouga (Portugal). I. General Hydrogeochemistry from Its Origin to the Ria de Aveiro,
W86-03776 2K

Evaluation of the Intensity of Some Recent Exogenic Geological Processes in the U.S.S.R. by the Hydrogeochemical Balances Method,
W86-03777 2K

Study of the Hydrochemical Regime and Its Long-Term Variations in the Case of Some Rivers in U.S.S.R.,
W86-03778 2K

Saline Groundwater Discharges from Crystalline Rocks Near Thunder Bay, Ontario, Canada,
W86-03786 2F

GEOHYDROLOGY
Groundwater Contamination and Emergency Response Guide,
W86-03457 5G

Ground Water in Carbonate Rocks and Regolith in the Fairview Area, Tennessee,
W86-03548 2F

African Groundwater Development-The Challenges for Hydrogeological Science,
W86-03563 2F

Groundwater Resources in Tropical African Regoliths,
W86-03564 2F

Character of Fractured Rock Aquifers in Eastern Botswana,
W86-03565 2F

Some Critical Issues with Monitoring Crystalline Rock Aquifers for Groundwater Management in Rural Areas,
W86-03567 2F

Characteristics of the Weathered Basement Aquifer in Malawi in Relation to Rural Water Supplies,
W86-03568 2F

Electric Logs for Groundwater Exploration in the Niger Delta.
W86-03570 2F

Water Resources Assessment Study in Kiambu District, Kenya,
W86-03571 2F

Artificial Recharge of Groundwater Resources in Semiarid Regions,
W86-03572 4B

Optimization of Conjunctive Use of Groundwater and Surface Water Resources in the Vaal Basin,
W86-03573 4B

Isotope Studies as a Final Stage in Groundwater Investigations on the African Shield,
W86-03574 2F

Isotopes in Groundwater Hydrology,
W86-03575 2F

Environmental Isotope Hydrology in Southern Africa,
W86-03576 2F

Groundwater Management by Means of a Quasi-Three-Dimensional Finite Element Flow Model,
W86-03577 2F

Role of Modeling in the Development of African Groundwater Resources,
W86-03578 2F

Gully Erosion in the Agulu-Nanka Region of Anambra State, Nigeria,
W86-03589 2J

Consequence Assessment of Hydrological Communications through Borehole Plugs,
W86-03629 5G

Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium.
W86-03753 5B

Role of Natural Organics on Water Interaction with Soil and Rock,
W86-03754 2K

Hydrogeochemical Evolution and Variability of Groundwater in Experimental Basins of S. W. Western Australia,
W86-03757 2F

Hydrochemical Processes in Groundwater Discharge Areas,
W86-03762 2F

Changes in Ground-Water Chemical Composition in Drained Peat Bogs in Connection with Environmental Protection Measures,
W86-03764 2F

Hydrochemistry of Springs from Dolomite Reefs in the Southern Alps of Northern Italy,
W86-03765 2K

Reliability of Information in Hydrogeochemical Investigations,
W86-03769 7A

Geochemical Studies in the Drainage Basin of the Rio Vouga (Portugal). I. General Hydrogeochemistry from Its Origin to the Ria de Aveiro,
W86-03776 2K

Evaluation of the Intensity of Some Recent Exogenic Geological Processes in the U.S.S.R. by the Hydrogeochemical Balances Method,
W86-03777 2K

Hydrochemical Budgeting in Studies of Ground-Water Renewability in Areas of Glacial Formation Systems,
W86-03783 2F

Saline Groundwater Discharges from Crystalline Rocks Near Thunder Bay, Ontario, Canada,
W86-03786 2F

Hydrochemical Relationships Between Rainwater, Floods, Groundwater and Lithology in the Avedat Group on the Negev Highlands, Israel,
W86-03789 2A

GEOLOGIC FRACTURES

Surface and Groundwater Mixing and Identification of Local Recharge-Discharge Zones from Seasonal Fluctuations of Oxygen-18 in Groundwater in Fissured Rock,
W86-03790 2F

GEOPHYSICS

Saline Groundwater Discharges from Crystalline Rocks Near Thunder Bay, Ontario, Canada,
W86-03786 2F

GEORGIA

Inland Travel of Tide-Driven Saline Water in the Altamaha and Satilla Rivers, Georgia, and the St. Marys River, Georgia-Florida,
W86-03561 2L

GIARDIASIS

Giardiasis in Washington State,
W86-03507 5C

GLACIAL DRIFT

World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland,
W86-03673 2C

Glaciers and Glaciolithic Systems of the Central Andes,
W86-03675 2C

Glacier Inventory in the Dudh Kosi Region, East Nepal,
W86-03682 2C

Distribution, Features and Variations of Glaciers in China,
W86-03684 2C

Climatic Background to Some Glacier Fluctuations,
W86-03699 2C

GLACIAL SEDIMENTS

Interaction Water-Silicate Minerals in the Unsaturated Zone Controlled by Thermodynamic Disequilibria,
W86-03756 2K

GLACIAL STREAMS

World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland,
W86-03673 2C

GLACIATION

Glacier Inventory in the Dudh Kosi Region, East Nepal,
W86-03682 2C

Material for a Glacier Inventory of the Indus Drainage Basin - The Nanga Parbat Massif,
W86-03683 2C

Present Glaciation in Turkey,
W86-03689 2C

Mountain Glaciers in the Mediterranean Area and in Africa,
W86-03691 2C

Use of the Data of Glacier Inventories for Compilation of the World Atlas of Snow and Ice Resources,
W86-03701 2C

GLACIER BALANCE

World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland,
W86-03673 2C

Glacier Inventory of Bolivia,
W86-03676 2C

GLACIER MASS BALANCE

East-West and North-South Snow Line Gradients in the Northern Patagonian Andes, Argentina,
W86-03674 2C

Glacier Inventory of Bolivia,
W86-03676 2C

Hydrological Basins in West Greenland and Their Relationship to a Preliminary Sectorial Division of the Inland Ice Sheet,
W86-03678 2C

Parameterization of Glacier Equilibrium Line Altitude,
W86-03696 2C

Can the Linear Balance Model Be Extended to the Whole Alps,
W86-03697 2C

Climatic Background to Some Glacier Fluctuations,
W86-03699 2C

GLACIER SURGES

World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland,
W86-03673 2C

Problems and Results of Studies of Mountain Glaciers in the Soviet Union,
W86-03686 2C

Studies of Glacier Fluctuations in the USSR,
W86-03687 2C

GLACIERS

World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland,
W86-03673 2C

East-West and North-South Snow Line Gradients in the Northern Patagonian Andes, Argentina,
W86-03674 2C

Glaciers and Glaciolithic Systems of the Central Andes,
W86-03675 2C

Glacier Inventory of Bolivia,
W86-03676 2C

Inventory of Canadian Glaciers: Procedures, Techniques, Progress and Applications,
W86-03677 2C

Hydrological Basins in West Greenland and Their Relationship to a Preliminary Sectorial Division of the Inland Ice Sheet,
W86-03678 2C

West Greenland Outlet Glaciers: An Inventory of the Major Iceberg Producers,
W86-03679 2C

Some Problems of Glacier Inventory in the Himalayas,
W86-03680 2C

Present and Late Pleistocene Equilibrium Line Altitudes in the Mt Everest Region - An Application of the Glacier Inventory,
W86-03681 2C

Glacier Inventory in the Dudh Kosi Region, East Nepal,
W86-03682 2C

Material for a Glacier Inventory of the Indus Drainage Basin - The Nanga Parbat Massif,
W86-03683 2C

Distribution, Features and Variations of Glaciers in China,
W86-03684 2C

Recent Research on Glaciers on the Chinhai-Tibet Plateau,
W86-03685 2C

Problems and Results of Studies of Mountain Glaciers in the Soviet Union,
W86-03686 2C

Studies of Glacier Fluctuations in the USSR,
W86-03687 2C

Special Problems of Glacier Inventory in Afghanistan,
W86-03688 2C

Present Glaciation in Turkey,
W86-03689 2C

Some Comments on the Swiss Glacier Inventory,
W86-03690 2C

Mountain Glaciers in the Mediterranean Area and in Africa,
W86-03691 2C

Glacier Snow Line Variations in the Southern Alps, New Zealand,
W86-03692 2C

Problem of a Glacier Inventory of Antarctica,
W86-03693 2C

Glacier Balances in the Dry Valleys Area, Victoria Land, Antarctica,
W86-03694 2C

Parameterization of Glacier Equilibrium Line Altitude,
W86-03696 2C

Can the Linear Balance Model Be Extended to the Whole Alps,
W86-03697 2C

Rock Glaciers: Glacial and Non-Glacial Origins,
W86-03698 2C

Climatic Background to Some Glacier Fluctuations,
W86-03699 2C

Effect of Topographic Orientation on the Variations of Glacier Length,
W86-03700 2C

Use of the Data of Glacier Inventories for Compilation of the World Atlas of Snow and Ice Resources,
W86-03701 2C

Use of Landsat Digital Information for Assessing Glacier Inventory Parameters,
W86-03702 2C

Satellite Image Atlas of Glaciers,
W86-03703 2C

GLACIOHYDROLOGY

World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland,
W86-03673 2C

East-West and North-South Snow Line Gradients in the Northern Patagonian Andes, Argentina,
W86-03674 2C

Glaciers and Glaciolithic Systems of the Central Andes,
W86-03675 2C

Glacier Inventory of Bolivia,
W86-03676 2C

Hydrological Basins in West Greenland and Their Relationship to a Preliminary Sectorial Division of the Inland Ice Sheet,
W86-03678 2C

Some Problems of Glacier Inventory in the Himalayas,
W86-03680 2C

Distribution, Features and Variations of Glaciers in China,
W86-03684 2C

Recent Research on Glaciers on the Chinhai-Tibet Plateau,
W86-03685 2C

Problems and Results of Studies of Mountain Glaciers in the Soviet Union,
W86-03686 2C

Studies of Glacier Fluctuations in the USSR,
W86-03687 2C

Special Problems of Glacier Inventory in Afghanistan,
W86-03688 2C

Present Glaciation in Turkey,
W86-03689 2C

Some Comments on the Swiss Glacier Inventory,
W86-03690 2C

Mountain Glaciers in the Mediterranean Area and in Africa,
W86-03691 2C

Glacier Snow Line Variations in the Southern Alps, New Zealand,
W86-03692 2C

Glacier Balances in the Dry Valleys Area, Victoria Land, Antarctica,
W86-03694 2C

GLACIOLOGY

World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland,
W86-03673 2C

Present and Late Pleistocene Equilibrium Line Altitudes in the Mt Everest Region - An Application of the Glacier Inventory,
W86-03681 2C

Glacier Inventory in the Dudh Kosi Region, East Nepal,
W86-03682 2C

Material for a Glacier Inventory of the Indus Drainage Basin - The Nanga Parbat Massif,
W86-03683 2C

Distribution, Features and Variations of Glaciers in China,
W86-03684 2C

Recent Research on Glaciers on the Chinhai-Tibet Plateau,
W86-03685 2C

Problems and Results of Studies of Mountain Glaciers in the Soviet Union,
W86-03686 2C

Studies of Glacier Fluctuations in the USSR,
W86-03687 2C

Special Problems of Glacier Inventory in Afghanistan,
W86-03688 2C

Some Comments on the Swiss Glacier Inventory,
W86-03690 2C

Mountain Glaciers in the Mediterranean Area and in Africa,
W86-03691 2C

Glacier Snow Line Variations in the Southern Alps, New Zealand,
W86-03692 2C

Glacier Balances in the Dry Valleys Area, Victoria Land, Antarctica,
W86-03694 2C

Parameterization of Glacier Equilibrium Line Altitude,
W86-03696 2C

Can the Linear Balance Model Be Extended to the Whole Alps,
W86-03697 2C

Rock Glaciers: Glacial and Non-Glacial Origins,
W86-03698 2C

Effect of Topographic Orientation on the Variations of Glacier Length,
W86-03700 2C

Use of the Data of Glacier Inventories for Compilation of the World Atlas of Snow and Ice Resources,
W86-03701 2C

Use of Landsat Digital Information for Assessing Glacier Inventory Parameters,
W86-03702 2C

Satellite Image Atlas of Glaciers,
W86-03703 2C

GLACIOLOY

Problem of a Glacier Inventory of Antarctica,
W86-03693 2C

GRAZING

Limits to the Control of Algal Populations by Grazing Zooplankton: The Environmental Theater and the Ecological Play,
W86-03489 5G

Algal Control through Trophic-Level Interactions: A Subtropical Persepctive,
W86-03490 5G

GREENLAND

Hydrological Basins in West Greenland and Their Relationship to a Preliminary Sectorial Division of the Inland Ice Sheet,
W86-03678 2C

West Greenland Outlet Glaciers: An Inventory of the Major Iceberg Producers,
W86-03679 2C

GROUNDWATER

Modeling Chemical Reactions and Transport in Groundwater Systems: A Review,
W86-03428 5B

Ground-Water Conditions of the Triassic Aquifer in Deaf Smith and Swisher Counties,
W86-03439 2F

Investigation of the Feasibility of Secondary Recovery of Ground Water from the Ogallala Aquifer: A Report to the Sixty-Eighth Legislature.
W86-03442 3B

Report of Analyses for Light Hydrocarbons in Ground Water,
W86-03512 5A

Groundwater Management Strategy for Michigan: Public Notification Methods.
W86-03513 5G

Geochemistry and Geohydrology of the West Decker and Big Sky Coal-Mining Areas, Southeastern Montana,
W86-03545 2K

Ground Water in Carbonate Rocks and Regolith in the Fairview Area, Tennessee,
W86-03548 2F

Hydrogeologic Data from a Test Well at Kathryn Abbey Hanna Park, City of Jacksonville, Florida,
W86-03555 2F

Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium,
W86-03562 2F

Characteristics of the Weathered Basement Aquifer in Malawi in Relation to Rural Water Supplies,
W86-03568 2F

Occurrence and Distribution of Fluoride in Groundwaters of Kenya,
W86-03569 2K

Water Resources Assessment Study in Kiambu District, Kenya,
W86-03571 2F

Isotope Studies as a Final Stage in Groundwater Investigations on the African Shield,
W86-03574 2F

Isotopes in Groundwater Hydrology,
W86-03575 2F

Environmental Isotope Hydrology in Southern Africa,
W86-03576 2F

Role of Modeling in the Development of African Groundwater Resources,
W86-03578 2F

Gully Erosion in the Agulu-Nanka Region of Anambra State, Nigeria,
W86-03589 2J

Water Resources Data, Colorado, Water Year 1981; Volume 3: Dolores River Basin, Green River Basin, and San Juan River Basin.
W86-03609 2E

Water Resource Data and Trend Analysis for the Blue Creek Watershed Project, Pike County, Illinois: Phase II,
W86-03610 5G

Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium.
W86-03753 5B

Role of Natural Organics on Water Interaction with Soil and Rock,
W86-03754 2K

Comparative Study of Sequential Redox Processes in Three British Aquifers,
W86-03758 2F

Hydrochemical Processes in Groundwater Discharge Areas,
W86-03762 2F

Changes in Ground-Water Chemical Composition in Drained Peat Bogs in Connection with Environmental Protection Measures,
W86-03764 2F

Temporal Changes in Ground Water Quality in the Phreatic Zone Uttar Pradesh (India) and Their Impact on Sampling Schedule,
W86-03768 2F

Evaluation of the Intensity of Some Recent Exogenic Geological Processes in the U.S.S.R. by the Hydrogeochemical Balances Method,
W86-03777 2K

Saline Groundwater Discharges from Crystalline Rocks Near Thunder Bay, Ontario, Canada,
W86-03786 2F

Hydrochemical Relationships Between Rainwater, Floods, Groundwater and Lithology in the Avedat Group on the Negev Highlands, Israel,
W86-03789 2A

GROUNDWATER AVAILABILITY
Groundwater Management by Means of a Quasi-Three-Dimensional Finite Element Flow Model,
W86-03577 2F

GROUNDWATER BASINS
Hydrogeochemical Evolution and Variability of Groundwater in Experimental Basins of S. W. Western Australia,
W86-03757 2F

GROUNDWATER DATING
Groundwater Quality Evolution in the Upper Aquifer of the Coastal Dune Area of the Western Netherlands,
W86-03761 2F

GROUNDWATER HYDROLOGY
Simulation of Physicochemical Interactions in a Water-Rock System in Assessing Ground-Water Quality,
W86-03759 2K

GROUNDWATER LEVEL
Ground-Water Levels in Arkansas, Spring 1984,
W86-03553 2F

GROUNDWATER MANAGEMENT
Groundwater Contamination and Emergency Response Guide,
W86-03457 5G

Some Critical Issues with Monitoring Crystalline Rock Aquifers for Groundwater Management in Rural Areas,
W86-03567 2F

Artificial Recharge of Groundwater Resources in Semiarid Regions,
W86-03572 4B

Optimization of Conjunctive Use of Groundwater and Surface Water Resources in the Vaal Basin,
W86-03573 4B

Groundwater Management by Means of a Quasi-Three-Dimensional Finite Element Flow Model,
W86-03577 2F

GROUNDWATER MOVEMENT
Modeling Chemical Reactions and Transport in Groundwater Systems: A Review,
W86-03428 5B

Mathematical Analysis of Groundwater Resources,
W86-03478 2F

Studies on Groundwater Transport in Fractured Crystalline Rock under Controlled Conditions Using Nonradioactive Tracers,
W86-03497 2F

Stochastic-Convective Ensemble Method for Representing Dispersive Transport in Groundwater,
W86-03498 5B

Chemical Quality of Landfill Leachate in Treatment Ponds and Migration of Leachate in the Surficial Aquifer, Pinellas County, Florida,
W86-03549 5B

Consequence Assessment of Hydrological Communications through Borehole Plugs,
W86-03629 5G

GROUNDWATER POLLUTION
Groundwater Contamination and Emergency Response Guide,
W86-03457 5G

Report of Analyses for Light Hydrocarbons in Ground Water,
W86-03512 5A

Nitrate Pollution of Groundwater Resources: Mechanisms and Modelling,
W86-03656 5B

Water Quality and Water Pollution Problems on the Indian Sub-Continent,
W86-03781 5B

GROUNDWATER POTENTIAL
African Groundwater Development-The Challenges for Hydrogeological Science,
W86-03563 2F

Groundwater Resources in Tropical African Regoliths,
W86-03564 2F

Character of Fractured Rock Aquifers in Eastern Botswana,
W86-03565 2F

Electric Logs for Groundwater Exploration in the Niger Delta.
W86-03570 2F

Water Resources Assessment Study in Kiambu District, Kenya,
W86-03571 2F

Hydrochemical Budgeting in Studies of Ground-Water Renewability in Areas of Glacial Formation Systems,
W86-03783 2F

GROUNDWATER RECHARGE
Estimating Groundwater Recharge Based on Infiltration Characteristics of Layered Soil,
W86-03566 2F

Artificial Recharge of Groundwater Resources in Semiarid Regions,
W86-03572 4B

Optimization of Conjunctive Use of Groundwater and Surface Water Resources in the Vaal Basin,
W86-03573 4B

Environmental Isotope Hydrology in Southern Africa,
W86-03576 2F

Hydrogeochemical Evolution and Variability of Groundwater in Experimental Basins of S. W. Western Australia,
W86-03757 2F

Hydrochemical Budgeting in Studies of Ground-Water Renewability in Areas of Glacial Formation Systems,
W86-03783 2F

Surface and Groundwater Mixing and Identification of Local Recharge-Discharge Zones from Seasonal Fluctuations of Oxygen-18 in Groundwater in Fissured Rock,
W86-03790 2F

GULF OF MEXICO
Proceedings: 2nd Annual Gulf of Mexico Information Transfer Meeting.
W86-03841 10D

GULLY EROSION
Gully Erosion in the Agulu-Nanka Region of Anambra State, Nigeria,
W86-03589 2J

HABITATS
Effects of Fluctuating Reservoir Water Levels on Fisheries, Wildlife, and Vegetation: Summary of a Workshop, 24-26 February 1981,
W86-03642 6G

HALOGENATED PESTICIDES
Mathematical Model, SERATRA, for Sediment-Contaminant Transport in Rivers and Its Appli-

cation to Pesticide Transport in Four Mile and Wolf Creeks in Iowa,
W86-03648 5B

HALOGENS
Groundwater Quality Evolution in the Upper Aquifer of the Coastal Dune Area of the Western Netherlands,
W86-03761 2F

HARBORS
Corpus Christi Inner Harbor Water Quality Survey, August 1982,
W86-03440 5B

HAZARDOUS MATERIALS
Emergency Response Equipment to Clean Up Hazardous Chemical Releases at Spills and Uncontrolled Waste Sites,
W86-03476 5G

Instrumentation and Methods Evaluations for Shallow Land Burial of Waste Materials: Water Erosion,
W86-03510 5E

Alternatives to Open Water Disposal of Contaminated Dredged Material,
W86-03879 5E

HEAVY METALS
Removal of Various Toxic Heavy Metals and Cyanide from Water by Membrane Processes,
W86-03532 5D

Demonstration of a Cross-Flow Microfiltration System from the Removal of Toxic Heavy Metals from Battery Manufacturing Wastewater Effluents,
W86-03533 5D

Lead and Cadmium in Precipitation in the Essex Region of Southwestern Ontario,
W86-03772 5B

Model Experimental Study of Hydrochemical Processes in the Saturated Zone,
W86-03785 2K

HERBICIDES
Rice Herbicides: Molinate (Ordram) and Thiobencarb (Bolero),
W86-03447 5G

HIGH PLAINS
Geologic and Hydrologic Data from a Test-Drilling Program in the High Plains Areas of South Dakota, 1979-1980,
W86-03558 2F

HIMALAYAS
Some Problems of Glacier Inventory in the Himalayas,
W86-03680 2C

Present and Late Pleistocene Equilibrium Line Altitudes in the Mt Everest Region - An Application of the Glacier Inventory,
W86-03681 2C

HUMAN DISEASES
Giardiasis in Washington State,
W86-03507 5C

HUMIC ACIDS
Role of Natural Organics on Water Interaction with Soil and Rock,
W86-03754 2K

HYDRAULIC EQUIPMENT
Slime Growth on Fine Bubble Diffusers,
W86-03672 5D

HYDRAULIC MACHINERY
Solar Powered Groundwater Pumping for Medium Heads,
W86-03583 8C

HYDRAULIC MODELS
Verification of the Chesapeake Bay Model: Chesapeake Bay Hydraulic Model Investigation,
W86-03459 2L

Revetment Stability Study, Fort Fisher State Historic Site, North Carolina: Hydraulic Model Investigation,
W86-03479 8A

User's Manual for EXPLORE-I: A River Basin Water Quality Model, Hydraulic Module Only,
W86-03646 2A

Hydrologic Modeling for Studies of Pollutant Loadings and Transport in Large River Basins,
W86-03827 5A

HYDRAULIC PROPERTIES
Predicting the Sediment Capacity of a Channel,
W86-03594 2J

HYDRODYNAMICS
Currents in Suisun Bay,
W86-03448 2L

HYDROELECTRIC PLANTS
Present and Potential Use of Micro-Hydro-Electric Schemes in Remote Locations,
W86-03505 8A

HYDROLOGIC BUDGET
Data Collection for Hydrochemical Balances: Theoretical Aspects,
W86-03766 2A

Mass-Balance Approach to the Understanding of Geochemical Processes in Aqueous Systems,
W86-03773 5B

Hydrochemical Budgets of Some Dutch Woodland Soils with High Inputs of Atmospheric Acid Deposition: Mobilization of Aluminum,
W86-03774 5B

Regional Water Balance in the Mountainous Arctic and Its Application for Water-Resource Planning,
W86-03849 2D

HYDROLOGIC CYCLE
Hydrogeochemical Evolution and Variability of Groundwater in Experimental Basins of S. W. Western Australia,
W86-03757 2F

HYDROLOGIC DATA
Hydrology of Area 1, Eastern Coal Province, Pennsylvania,
W86-03547 2E

Water Resources Data, Colorado, Water Year 1981; Volume 3: Dolores River Basin, Green River Basin, and San Juan River Basin.
W86-03609 2E

Water Resource Data and Trend Analysis for the Blue Creek Watershed Project, Pike County, Illinois: Phase II,
W86-03610 5G

Streamflow Summaries from Twelve Tributaries of Farmington Creek, Davis County Experimental Watershed, Northern Utah,
W86-03640 2A

HYDROLOGIC DATA COLLECTION
Conditions and Frequency of Sampling for Elucidations of Transport Mechanisms and Element Budgets in Upland Drainage Basins,
W86-03770 7A

HYDROLOGIC DATA COLLECTIONS
Currents in San Pablo Bay,
W86-03449 2L

Hydrogeological Data Collection, Storage, Retrieval and Water Law in Botswana,
W86-03580 7C

Appraisal of Sediment Transport Measurement in Ghanaian Rivers,
W86-03586 7A

East-West and North-South Snow Line Gradients in the Northern Patagonian Andes, Argentina,
W86-03674 2C

Data Collection for Hydrochemical Balances: Theoretical Aspects,
W86-03766 2A

Design of a Hydrochemical Data Collection Programme,
W86-03767 7A

Temporal Changes in Ground Water Quality in the Phreatic Zone Uttar Pradesh (India) and Their Impact on Sampling Schedule,
W86-03768 2F

HYDROLOGIC MAPS
Material for a Glacier Inventory of the Indus Drainage Basin - The Nanga Parbat Massif,
W86-03683 2C

Distribution, Features and Variations of Glaciers in China,
W86-03684 2C

Special Problems of Glacier Inventory in Afghanistan,
W86-03688 2C

Some Comments on the Swiss Glacier Inventory,
W86-03690 2C

Use of the Data of Glacier Inventories for Compilation of the World Atlas of Snow and Ice Resources,
W86-03701 2C

Satellite Image Atlas of Glaciers,
W86-03703 2C

HYDROLOGIC MODELS
Hydrologic Transport Modeling,
W86-03427 5B

Large-Scale Operations Management Test of Use of the White Amur for Control of Problem Aquatic Plants, Report 2: First Year Poststocking Results,
W86-03454 2H

Application Guide for Hydrological Simulation Program: FORTRAN (HSPF),
W86-03614 2A

Can the Linear Balance Model Be Extended to the Whole Alps,
W86-03697 2C

Climatic Background to Some Glacier Fluctuations,
W86-03699 2C

Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium.
W86-03753 5B

Hydrochemical Budgeting in Studies of Ground-Water Renewability in Areas of Glacial Formation Systems,
W86-03783 2F

Model Experimental Study of Hydrochemical Processes in the Saturated Zone,
W86-03785 2K

Separation of Runoff Components by NO3-N Loading and Estimation of Runoff Loading by Each Component,
W86-03788 5B

HYDROLOGIC MODELS

Hydrochemical Relationships Between Rainwater, Floods, Groundwater and Lithology in the Avedat Group on the Negev Highlands, Israel,
W86-03789 2A

Proceedings of Stormwater and Water Quality Management Modeling Users Group Meeting.
W86-03822 5B

Study of the Selection, Calibration and Verification of Mathematical Water Quality Models,
W86-03823 5B

Hydrologic Modeling for Studies of Pollutant Loadings and Transport in Large River Basins,
W86-03827 5A

HYDROLOGICAL DATA COLLECTIONS

Low Cost Hydrological Data Collection,
W86-03581 7B

Inventory of Canadian Glaciers: Procedures, Techniques, Progress and Applications,
W86-03677 2C

Reliability of Information in Hydrogeochemical Investigations,
W86-03769 7A

HYDROLOGY

Military Hydrology; Report 3: A Review of Army Doctrine on Military Hydrology,
W86-03456 10F

Isotopes in Groundwater Hydrology,
W86-03575 2F

HYDROLYSIS

Mathematical Model, SERATRA, for Sediment-Contaminant Transport in Rivers and Its Application to Pesticide Transport in Four Mile and Wolf Creeks in Iowa,
W86-03648 5B

ICE COVER

Glaciers and Glaciolithic Systems of the Central Andes,
W86-03675 2C

Hydrological Basins in West Greenland and Their Relationship to a Preliminary Sectorial Division of the Inland Ice Sheet,
W86-03678 2C

Some Problems of Glacier Inventory in the Himalayas,
W86-03680 2C

Recent Secular Variations of Snow and Sea Ice Cover,
W86-03695 2C

Use of Landsat Digital Information for Assessing Glacier Inventory Parameters,
W86-03702 2C

ICE FORMATION

Ice Forming Experiment,
W86-03641 2C

ICEBERGS

West Greenland Outlet Glaciers: An Inventory of the Major Iceberg Producers,
W86-03679 2C

ILLINOIS

Water Resource Data and Trend Analysis for the Blue Creek Watershed Project, Pike County, Illinois: Phase II,
W86-03610 5G

INDEXING

Aquaculture Thesaurus: Descriptors Used in the National Aquaculture Information System,
W86-03643 10C

INDIA

Some Problems of Glacier Inventory in the Himalayas,
W86-03680 2C

Material for a Glacier Inventory of the Indus Drainage Basin - The Nanga Parbat Massif,
W86-03683 2C

Water Quality and Water Pollution Problems on the Indian Sub-Continent,
W86-03781 5B

INDUSTRIAL WASTES

Implementation of Sequencing Batch Reactors for Municipal Wastewater Treatment,
W86-03664 5D

INDUSTRIAL WASTEWATER

Chemistry in Water Reuse: Volume 1,
W86-03520 5D

Quality Assurance in the Evaluation of Pollution Control Technology: Experiences at the Industrial Environmental Research Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio,
W86-03530 5A

Removal of Various Toxic Heavy Metals and Cyanide from Water by Membrane Processes,
W86-03532 5D

Coupled Transport Membranes for Removal of Chromium from Electroplating Rinse Solutions,
W86-03534 5D

Wastewater Treatment System for a Lurgi Coal Gasification Plant,
W86-03639 5D

Proceedings of the 6th Symposium on Wastewater Treatment,
W86-03659 5D

Determination of Phenolic Water Pollutants by Glass Capillary Gas Chromatography,
W86-03799 5A

Determination of Priority Pollutants in Industrial Wastewaters by Stable-Isotope Dilution Gas Chromatography/Mass Spectrometry,
W86-03804 5A

Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment.
W86-03883 5D

Biological Inhibition Screening of Industrial Wastewaters,
W86-03888 5D

Treatment of Municipal Wastewaters Containing Biologically Hazardous Industrial Compounds by Conventional Activated Sludge and Extended Aeration,
W86-03889 5D

INDUSTRIAL WATER

Texas Manufacturing Water Use: Long-Term Projections,
W86-03441 6D

Drought-Related Impacts on Municipal and Major Self-Supplied Industrial Water Withdrawals in Tennessee, (Part A and Part B),
W86-03560 6D

INFECTION

Giardiasis in Washington State,
W86-03507 5C

INFILTRATION

Streamflow Augmentation at Fosters Brook, Long Island, New York - A Hydraulic Feasibility Study,
W86-03551 4A

Estimating Groundwater Recharge Based on Infiltration Characteristics of Layered Soil,
W86-03566 2F

Hydrochemical Budgeting in Studies of Ground-Water Renewability in Areas of Glacial Formation Systems,
W86-03783 2F

INFORMATION EXCHANGE

Directory of Member Organizations of the National Water Data Exchange (NAWDEX),
W86-03557 10D

Ecological Solutions to Environmental Management Concerns in the Pinelands National Reserve: Proceedins of a Conference,
W86-03616 2L

Proceedings: 2nd Annual Gulf of Mexico Information Transfer Meeting.
W86-03841 10D

INFORMATION RETRIEVAL

Directory of Member Organizations of the National Water Data Exchange (NAWDEX),
W86-03557 10D

INFORMATION SYSTEMS

Groundwater Management Strategy for Michigan: Public Notification Methods.
W86-03513 5G

INSTITUTIONAL CONSTRAINTS

Joint Hydrogeological Surveys,
W86-03579 6E

INSTREAM AERATION

Assessment of the Measurement Uncertainty in the Estimation of Stream Reaeration Rate Coefficients Using Direct Tracer Techniques,
W86-03824 5A

INSURANCE

Levee Policy for the National Flood Insurance Program,
W86-03622 6F

INTAKE GATES

Procedure for Developing Biological Input for the Design, Location, or Modification of Water-Intake Structures,
W86-03519 8I

INTERBASIN TRANSFERS

Viability of Interbasin, Interstate/International Transfers of Water,
W86-03436 6D

INTERNAL WAVES

Waterloo Clarifier: Principles and Practice,
W86-03663 5D

INTERSTITIAL WATER

Interaction Water-Silicate Minerals in the Unsaturated Zone Controlled by Thermodynamic Disequilibria,
W86-03756 2K

Measurement of Nutrient Concentrations in Sediment Pore Water Collected by a Dialysis Sampler,
W86-03877 5A

INVERTEBRATES

Aquaculture and Dredged Material Containment Sites: Significance of Contaminated Sediments,
W86-03714 5B

ION-EXCHANGE

Preparation of Ion-Exchange Membranes with Extremely Low Areal Resistances,
W86-03615 3A

Anionic and Neutral Organic Components in Water by Anion Exchange,
W86-03810 5A

ION TRANSPORT
Study of the Hydrochemical Regime and Its Long-Term Variations in the Case of Some Rivers in U.S.S.R.,
W86-03778 2K

Model Experimental Study of Hydrochemical Processes in the Saturated Zone,
W86-03785 2K

IONS
Respiratory Gas Content (O2 and CO2) and Ionic Composition of River Water in the Plain of Alsace (Eastern France),
W86-03763 2F

Study of the Hydrochemical Regime and Its Long-Term Variations in the Case of Some Rivers in U.S.S.R.,
W86-03778 2K

IRRIGATION EFFECTS
Integrated Physical-Economic Systems Analysis of Irrigated Agriculture,
W86-03658 5G

ISOTOPE STUDIES
Isotope Studies as a Final Stage in Groundwater Investigations on the African Shield,
W86-03574 2F

Isotopes in Groundwater Hydrology,
W86-03575 2F

Environmental Isotope Hydrology in Southern Africa,
W86-03576 2F

ISOTOPIC TRACERS
Hydrochemistry of Springs from Dolomite Reefs in the Southern Alps of Northern Italy,
W86-03765 2K

Surface and Groundwater Mixing and Identification of Local Recharge-Discharge Zones from Seasonal Fluctuations of Oxygen-18 in Groundwater in Fissured Rock,
W86-03790 2F

ISRAEL
Gross Organics Measurements for Monitoring of Wastewater Treatment and Reuse,
W86-03523 5A

KAOLINITE
Interaction Water-Silicate Minerals in the Unsaturated Zone Controlled by Thermodynamic Disequilibria,
W86-03756 2K

KINETICS
Rational Approaches in the Analysis of Chemical Disinfection Kinetics,
W86-03538 5D

Some Implication of the Role of Kinetics in Enhancing Element Transport,
W86-03760 2K

Mass-Balance Approach to the Understanding of Geochemical Processes in Aqueous Systems,
W86-03773 5B

Evaluation of the Intensity of Some Recent Exogenic Geological Processes in the U.S.S.R. by the Hydrogeochemical Balances Method,
W86-03777 2K

KRAFT MILLS
Stripping Kraft Foul Condensates with Waste Gases,
W86-03624 5D

LAGOONS
Chemical Quality of Landfill Leachate in Treatment Ponds and Migration of Leachate in the Surficial Aquifer, Pinellas County, Florida,
W86-03549 5B

LAKE RESTORATION
Dredging and Management Problems in Lake Suwa,
W86-03462 5G

Restoration Study of Dredging in Lake Ksaumigaura,
W86-03468 5G

State-of-the-Art Summary of Phosphorus Inactivation as a Lake Restoration Technique,
W86-03486 5G

Aeration/Circulation for Control of Algal Production,
W86-03487 2G

LAKE SEDIMENTS
Comparison of Methods for Estimating Nutrient Release from Lake Sediments,
W86-03477 5B

Role of Bottom Sediments in Modifying Soluble Phosphate Loads to a Dendritic, Hypertrophic Reservoir,
W86-03787 2J

Hypolimnetic Oxygen Deficit in a Eutrophic Lake and the Role of Sediment Oxygen Demand,
W86-03869 5C

LAKES
Chemical and Physical Properties of Connecticut Lakes,
W86-03438 2H

Large-Scale Operations Management Test of Use of the White Amur for Control of Problem Aquatic Plants, Report 1: Baseline Studies, Volume V, The Herpetofauna of Lake Conway, Florida,
W86-03458 2H

Boundary Conditions of Sediment Surfaces Viewed from DO Behavior,
W86-03467 2H

Preliminary Guide to the Onsite Identification and Delineation of the Wetlands of the South Atlantic United States,
W86-03480 2H

Preliminary Guide to the Onsite Identification and Delineation of the Wetlands of the Interior United States.
W86-03482 2H

Dissolved Organic Matter and Lake Metabolism: Biogeochemistry and Controls of Nutrient Flux Dynamics in Lakes,
W86-03504 2H

Phytoplankton-Environmental Interactions in Reservoirs: Volume 1.
W86-03716 2H

Phytoplankton-Nutrient Kinetics Mechanisms in Mathematical Simulation Models, with Special Attention to Reservoirs and Impoundments,
W86-03717 2H

Modeling Combined Effects of Environmental Factors on Phytoplankton,
W86-03718 2H

Use and Interpretation of Detailed, Mechanistic Models of Phytoplankton Dynamics,
W86-03719 2H

Nitrogen Fixation and Phytoplankton Interactions in Southwestern Reservoirs,
W86-03720 2H

DCMU-Enhanced Chlorophyll Fluorescence as an Indication of the Physiological Status of Reservoir Phytoplankton: An Initial Evaluation,
W86-03721 2H

Phytoplankton Effects of Reservoir Use,
W86-03722 5G

Use of Bioassay Approaches for Assessing Phytoplankton Growth in Lakes and Reservoirs,
W86-03723 5C

Relationship of Common Dominant Phytoplankton to Water Temperature and Season,
W86-03724 2H

Relationship of Common Phytoplankton Genera to Nutrients in Eastern and Southeastern Lakes,
W86-03725 2H

Effect of Light Attenuation on the Relationship of Phytoplankton Biomass to Phosphorus Levels,
W86-03726 2H

Recent Rates of Sedimentation in the Mississippi River,
W86-03741 2J

Hypolimnetic Oxygen Deficit in a Eutrophic Lake and the Role of Sediment Oxygen Demand,
W86-03869 5C

LAND DISPOSAL
Effect of Soil on the Mutagenic Properties of Waste Water,
W86-03502 5C

Instrumentation and Methods Evaluations for Shallow Land Burial of Waste Materials: Water Erosion,
W86-03510 5E

Final Environmental Impact Statement for Sludge Disposal for the Des Moines Integrated Community Area,
W86-03635 5E

Land Treatment of Combined Municipal/Industrial Wastewaters,
W86-03896 5D

Utilization of Sewage Sludges on Cropland,
W86-03897 5E

LAND USE
Dirty Devil Project: Class II Cultral Resources Inventory in Central Utah,
W86-03518 6G

Hydrology and Land Use in Van Buren County, Michigan,
W86-03554 2E

Measurement of Soil Loss from Experimental Basins in Malawi,
W86-03590 2J

Some Methods for Evaluating Soil Erosion Risk,
W86-03593 2J

Final Environmental Impact Statement for Sludge Disposal for the Des Moines Integrated Community Area,
W86-03635 5E

Effects of Regional Water Management on N-Pollution in Areas with Intensive Agriculture,
W86-03650 5G

LANDFILL LEACHATE
Chemical Quality of Landfill Leachate in Treatment Ponds and Migration of Leachate in the Surficial Aquifer, Pinellas County, Florida,
W86-03549 5B

LANDFILLS
Chemical Quality of Landfill Leachate in Treatment Ponds and Migration of Leachate in the Surficial Aquifer, Pinellas County, Florida,
W86-03549 5B

LEACHATES
Stochastic-Convective Ensemble Method for Representing Dispersive Transport in Groundwater,
W86-03498 5B

Transport of Contaminants from Energy Process Waste Leachates through Subsurface Soils and Soil Components Laboratory Experiments,
W86-03500 5B

LEACHING
Some Implication of the Role of Kinetics in Enhancing Element Transport,
W86-03760 2K

LEAD
Lead and Cadmium in Precipitation in the Essex Region of Southwestern Ontario,
W86-03772 5B

LEGAL ASPECTS
Legal Environment of a Containment Site: Laws Governing the Acquisition, Maintenance, and Operation of Dredged Material Disposal Sites,
W86-03715 6E

Validation and Priority Pollutant Analysis,
W86-03792 5A

Legal Implications of Coastal Erosion in Louisiana,
W86-03860 6E

LEVEES
Levee Policy for the National Flood Insurance Program,
W86-03622 6F

LIGHT QUALITY
Effect of Light Attenuation on the Relationship of Phytoplankton Biomass to Phosphorus Levels,
W86-03726 2H

LITERATURE REVIEW
Evaluation of the Published Literature in the Water Reuse/Recycle Area,
W86-03521 3E

Removal of Various Toxic Heavy Metals and Cyanide from Water by Membrane Processes,
W86-03532 5D

LOADING FACTORS
Use of Continuous Simulation Model Calibration Techniques to Develop Nonpoint Pollution Loading Factors,
W86-03828 5B

LONG-TERM PLANNING
Texas Manufacturing Water Use: Long-Term Projections,
W86-03441 6D

LONGTERM PLANNING
WATER 2000: Conservation Program.
W86-03445 3D

LOUISIANA
Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options.
W86-03850 2J

Sedimentation and Apparent Sea-Level Rise as Factors Affecting Land Loss in Coastal Louisiana,
W86-03851 2J

Assessment of Geological and Human Factors Responsible for Louisiana Coastal Barrier Erosion,
W86-03852 2J

Mudflat and Marsh Progradation Along Louisiana's Chenier Plain: A Natural Reversal in Coastal Erosion,
W86-03853 2J

Wetland Loss Directly Associated with Canal Dredging in the Louisiana Coastal Zone,
W86-03854 6G

Canals and Wetland Erosion Rates in Coastal Louisiana,
W86-03855 6G

Effect of Coastal Alteration on Marsh Plants,
W86-03856 2L

Effects of Wetland Deterioration on the Fish and Wildlife Resources of Coastal Louisiana,
W86-03857 2L

Some Consequences of Wetland Modification to Louisiana's Fisheries,
W86-03858 2L

Wetland Losses and Coastal Fisheries: An Enigmatic and Economically Significant Dependency,
W86-03859 2L

Legal Implications of Coastal Erosion in Louisiana,
W86-03860 6E

Economic and Cultural Consequences of Land Loss in Louisiana,
W86-03861 6G

Future Sea Level Changes Along the Louisiana Coast,
W86-03862 2L

Sand Dune Vegetation and Stabilization in Louisiana,
W86-03864 2J

Reversal of Coastal Erosion by Rapid Sedimentation: The Atchafalaya Delta (South-Central Louisiana),
W86-03865 2J

Comparison of Effectiveness of Management Options for Wetland Loss in the Coastal Zone of Louisiana,
W86-03866 2L

MACROPHYTES
Use of Aquatic Macrophytes for Sludge Treatment,
W86-03669 5D

MAGNESIUM
Hydrochemistry of Springs from Dolomite Reefs in the Southern Alps of Northern Italy,
W86-03765 2K

MANAGEMENT PLANNING
Relationship Between Stream Recreational Use and Stream Characteristics with Implications for Management of Illinois Streams,
W86-03451 5G

Planning Approach for Improved Management of Illinois Streams for Recreation and Conservation,
W86-03452 5G

Comparison of Effectiveness of Management Options for Wetland Loss in the Coastal Zone of Louisiana,
W86-03866 2L

MAPPING
Hydrological Basins in West Greenland and Their Relationship to a Preliminary Sectorial Division of the Inland Ice Sheet,
W86-03678 2C

Problem of a Glacier Inventory of Antarctica,
W86-03693 2C

MAPS
Some Methods for Evaluating Soil Erosion Risk,
W86-03593 2J

MARSH PLANTS
Effect of Coastal Alteration on Marsh Plants,
W86-03856 2L

MARSHES
Sedimentation and Apparent Sea-Level Rise as Factors Affecting Land Loss in Coastal Louisiana,
W86-03851 2J

Wetland Loss Directly Associated with Canal Dredging in the Louisiana Coastal Zone,
W86-03854 6G

Canals and Wetland Erosion Rates in Coastal Louisiana,
W86-03855 6G

Effect of Coastal Alteration on Marsh Plants,
W86-03856 2L

Effects of Wetland Deterioration on the Fish and Wildlife Resources of Coastal Louisiana,
W86-03857 2L

Some Consequences of Wetland Modification to Louisiana's Fisheries,
W86-03858 2L

Wetland Losses and Coastal Fisheries: An Enigmatic and Economically Significant Dependency,
W86-03859 2L

Reversal of Coastal Erosion by Rapid Sedimentation: The Atchafalaya Delta (South-Central Louisiana),
W86-03865 2J

MASS SPECTROMETRY
Master Analytical Scheme: An Assessment of Factors Influencing Precision and Accuracy of Gas Chromatography/Mass Spectrometry Data,
W86-03795 5A

MATHEMATICAL ANALYSIS
Desk Top Methodology for Nonpoint Source Load Evaluation,
W86-03836 5B

MATHEMATICAL EQUATIONS
User's Manual for the Instream Sediment-Contaminant Transport Model SERATRA,
W86-03630 5B

Functional Design of Activated Sludge Processes,
W86-03670 5D

Mass-Balance Approach to the Understanding of Geochemical Processes in Aqueous Systems,
W86-03773 5B

MATHEMATICAL MODELS
Stochastic-Convective Ensemble Method for Representing Dispersive Transport in Groundwater,
W86-03498 5B

Nonlinear Programming Model of a Wastewater Treatment System: Sensitivity Analysis and a Robustness Constraint,
W86-03511 5D

User's Manual for the Instream Sediment-Contaminant Transport Model SERATRA,
W86-03630 5B

User's Manual for EXPLORE-I: A River Basin Water Quality Model, Hydraulic Module Only,
W86-03646 2A

Mathematical Model, SERATRA, for Sediment-Contaminant Transport in Rivers and Its Application to Pesticide Transport in Four Mile and Wolf Creeks in Iowa,
W86-03648 5B

Computation of Fractional Removal of Discrete and Flocculant Particles in Settling Basins,
W86-03667 5D

Functional Design of Activated Sludge Processes,
W86-03670 5D

Carbon Dioxide in the Soil Atmosphere: Simulation Model Parameter Estimation from Field Measurements,
W86-03755 2G

Accumulation and Transport of Water and Solutes in the Saturated and Unsaturated Zones,
W86-03784 2F

Proceedings of Stormwater and Water Quality Management Modeling Users Group Meeting.
W86-03822 5B

Study of the Selection, Calibration and Verification of Mathematical Water Quality Models,
W86-03823 5B

Calibration of Hydrology and Sediment Transport on Small Agricultural Watersheds Using HSPF,
W86-03825 2J

Continuous DO Response Predicted Using CSPSS Is Verified for Springfield, Missouri,
W86-03826 5B

Hydrologic Modeling for Studies of Pollutant Loadings and Transport in Large River Basins,
W86-03827 5A

Use of Continuous Simulation Model Calibration Techniques to Develop Nonpoint Pollution Loading Factors,
W86-03828 5B

Dynamic Model Adjustment,
W86-03831 2A

Improved Surcharge Computation, in EXTRAN,
W86-03832 3A

Predictive Model for Highway Runoff Pollutant Concentrations and Loadings,
W86-03834 2A

Chimney Hill Off-Site Drainage Study,
W86-03835 2A

Continuous Simulation of Instream Fecal Coliform Bacteria,
W86-03837 5B

Atmospheric Pollution in Relation to Storm Water Quality Modelling: Literature Review for an Industrial City,
W86-03838 5B

MATHEMATICAL STUDIES

Mathematical Analysis of Groundwater Resources,
W86-03478 2F

Probable Maximum Precipitation Estimates for the Drainage Above Dewey Dam, Johns Creek, Kentucky,
W86-03503 2B

Computation of Fractional Removal of Discrete and Flocculant Particles in Settling Basins,
W86-03667 5D

Dynamic Model Adjustment,
W86-03831 2A

Preparing a Design Storm,
W86-03833 2A

MEASURING INSTRUMENTS

1981 CCOPE PROBE Mesonet Calibration and Maintenance Procedures,
W86-03481 7B

Low Cost Hydrological Data Collection,
W86-03581 7B

Continuous Monitoring of Rainfall, Streamflow and Suspended Sediment Concentration in Semi-arid Environments,
W86-03591 7B

Multi-Parameter Remote Measurement of Rainfall,
W86-03618 2B

MEAT PROCESSING INDUSTRY

Water and Waste Management in the Canadian Meat and Poultry Processing Industry,
W86-03612 5E

MEMBRANE FILTERS

Filtrable Solids as a Design Parameter for Wastewater Treatment Processes,
W86-03662 5D

MEMBRANE PROCESSES

Removal of Various Toxic Heavy Metals and Cyanide from Water by Membrane Processes,
W86-03532 5D

Coupled Transport Membranes for Removal of Chromium from Electroplating Rinse Solutions,
W86-03534 5D

Hyperfiltration of Textile Process Water for Reuse,
W86-03535 5D

Removal of Chemical Carcinogens from Water/Wastewater by Reverse Osmosis,
W86-03536 5D

Potential of Reverse Osmosis for Recycling and Reuse of Sewage Effluents,
W86-03537 5D

MEMBRANES

Preparation of Ion-Exchange Membranes with Extremely Low Areal Resistances,
W86-03615 3A

MERCURY

Status Report on Compliance with the Chlor-Alkali Mercury Liquid Effluent Regulations 1978-79,
W86-03613 5D

Status Report on Compliance with the Chlor-Alkali Mercury Liquid Effluent Regulations 1980-81,
W86-03633 5E

METAL FINISHING WASTES

Coupled Transport Membranes for Removal of Chromium from Electroplating Rinse Solutions,
W86-03534 5D

METALS

Capping of Dredged Material Disposal Management for New York Harbor,
W86-03464 5G

Distribution and Enrichment of Trace Metals (Cd, Cr, Cu, Ni, Pb, Zn) in Bottom Sediments of Navigation Pools 4 (Lake Pepin), 5 and 9 of the Upper Mississippi River,
W86-03742 5B

Longitudinal Distribution of Trace Elements (As, Cd, Cr, Hg, Pb, and Se) in Fishes and Sediments in the Upper Mississippi River,
W86-03743 5B

Heavy Metal Accumulation in Selected Sessile Components of Fountain City Bay, Pool 5A, of the Upper Mississippi River,
W86-03744 5B

Trace Elements in the Water, Sediments, and Fish of the Upper Mississippi River, Twin Cities Metropolitan Area,
W86-03745 5B

Some Implication of the Role of Kinetics in Enhancing Element Transport,
W86-03760 2K

METEOROLOGICAL DATA COLLECTION

1981 CCOPE PROBE Mesonet Calibration and Maintenance Procedures,
W86-03481 7B

Investigations of Large Scale Storm Systems: Final Report,
W86-03647 2B

METHANE

Anaerobic Pretreatment Facility Also Provides Sludge Disposal Capability and Source of Renewable Energy for Food Processor,
W86-03661 5D

Comparison of Stirred Suspension and Fixed Film Anaerobic Digestion Systems,
W86-03668 5D

MICHIGAN

Hydrology and Land Use in Van Buren County, Michigan,
W86-03554 2E

MICROWAVES

Multi-Parameter Remote Measurement of Rainfall,
W86-03618 2B

MILITARY HYDROLOGY

Military Hydrology; Report 3: A Review of Army Doctrine on Military Hydrology,
W86-03456 10F

MINE WATER

Environmental Isotope Hydrology in Southern Africa,
W86-03576 2F

MINERAL WATER

Evaluation of the Intensity of Some Recent Exogenic Geological Processes in the U.S.S.R. by the Hydrogeochemical Balances Method,
W86-03777 2K

MINERALIZATION

Study of Anthropogenic Influence on Water Quality in Some Rivers of the Baltic Sea Basin,
W86-03779 5B

MINERALS

Interaction Water-Silicate Minerals in the Unsaturated Zone Controlled by Thermodynamic Disequilibria,
W86-03756 2K

Groundwater Quality Evolution in the Upper Aquifer of the Coastal Dune Area of the Western Netherlands,
W86-03761 2F

Geochemical Studies in the Drainage Basin of the Rio Vouga (Portugal). I. General Hydrogeochemistry from Its Origin to the Ria de Aveiro,
W86-03776 2K

MISSISSIPPI RIVER

Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium.
W86-03737 6G

MIXING

Surface and Groundwater Mixing and Identification of Local Recharge-Discharge Zones from Seasonal Fluctuations of Oxygen-18 in Groundwater in Fissured Rock,
W86-03790 2F

MODEL STUDIES
Role of Environmental Transport and Fate Models in Implementing the Toxic Substances Control Act,
W86-03420 5B

Predictive Fate Models: Their Role in the U.S. Environmental Protection Agency's Water Program,
W86-03421 5B

Identification and Evaluation of Fundamental Transport and Transformation Process Models,
W86-03422 5B

Significance and Limitations of Environmental Compartmentalization Models in the Control of New Chemicals Based on the Organization for Economic Cooperation and Development Minimum Premarketing Set of Data,
W86-03423 5G

Evaluative Model for Estimating Environmental Fate,
W86-03424 5B

Fate and Transport Modeling for Toxic Substances,
W86-03425 5B

Simplified Model of the Fate of Partitioning Chemicals in Lakes and Streams,
W86-03426 5B

Hydrologic Transport Modeling,
W86-03427 5B

Modeling Chemical Reactions and Transport in Groundwater Systems: A Review,
W86-03428 5B

Complex Effluent Fate Modeling,
W86-03429 5B

Testing Models of the Fate of Chemicals in Aquatic Environments,
W86-03430 5B

Field Validation and Error Analysis of Chemical Fate Models,
W86-03431 5B

Field Validation of Exposure Analysis Modeling System (EXAMS) in a Flowing Stream,
W86-03432 5B

Assessment of Transport and Fate of Toxic Materials in an Experimental Stream Ecosystem,
W86-03433 5B

Legal Validation of Environmental Fate Models,
W86-03434 5G

Simulation of Estuarine Silt Transport According to Storm Water Runoff,
W86-03465 2J

Mathematical Analysis of Groundwater Resources,
W86-03478 2F

Revetment Stability Study, Fort Fisher State Historic Site, North Carolina: Hydraulic Model Investigation,
W86-03479 8A

Groundwater Management by Means of a Quasi-Three-Dimensional Finite Element Flow Model,
W86-03577 2F

Role of Modeling in the Development of African Groundwater Resources,
W86-03578 2F

Sediment Yield Estimation and the Design of Sediment Control Structures in Rural Africa,
W86-03595 4D

Sheet Erosion from Arable Lands in Zimbabwe: Prediction and Control,
W86-03596 2J

Application Guide for Hydrological Simulation Program: FORTRAN (HSPF),
W86-03614 2A

User's Manual for the Instream Sediment-Contaminant Transport Model SERATRA,
W86-03630 5B

Comparison of Soil Moisture Characteristics Predicted by the Arya-Paris Model with Laboratory-Measured Data,
W86-03636 2G

Evaluation of Selected One-Dimensional Stream Water-Quality Models with Field Data,
W86-03644 5B

Nitrate Pollution of Groundwater Resources: Mechanisms and Modelling,
W86-03656 5B

Functional Design of Activated Sludge Process-es,
W86-03670 5D

Can the Linear Balance Model Be Extended to the Whole Alps,
W86-03697 2C

Phytoplankton-Nutrient Kinetics Mechanisms in Mathematical Simulation Models, with Special Attention to Reservoirs and Impoundments,
W86-03717 2H

Modeling Combined Effects of Environmental Factors on Phytoplankton,
W86-03718 2H

Use and Interpretation of Detailed, Mechanistic Models of Phytoplankton Dynamics,
W86-03719 2H

Carbon Dioxide in the Soil Atmosphere: Simulation Model Parameter Estimation from Field Measurements,
W86-03755 2G

Some Implication of the Role of Kinetics in Enhancing Element Transport,
W86-03760 2K

Applied Climatology.
W86-03846 2B

Discharge Forecasting from Glacierized Areas to Optimize Hydroelectric Power Management,
W86-03848 8C

MODEL TESTING
Field Validation and Error Analysis of Chemical Fate Models,
W86-03431 5B

Assessment of Transport and Fate of Toxic Materials in an Experimental Stream Ecosystem,
W86-03433 5B

Verification of the Chesapeake Bay Model: Chesapeake Bay Hydraulic Model Investigation,
W86-03459 2L

MODELS
Comparison of Stirred Suspension and Fixed Film Anaerobic Digestion Systems,
W86-03668 5D

MONITORING
Polychlorinated Biphenyls (PCBs),
W86-03446 5G

Groundwater Contamination and Emergency Response Guide,
W86-03457 5G

Gross Organics Measurements for Monitoring of Wastewater Treatment and Reuse,
W86-03523 5A

Development of a TOC/COD Analyzer for Process Applications,
W86-03526 5A

Some Critical Issues with Monitoring Crystalline Rock Aquifers for Groundwater Management in Rural Areas,
W86-03567 2F

Continuous Monitoring of Rainfall, Streamflow and Suspended Sediment Concentration in Semi-arid Environments,
W86-03591 7B

Water Quality Monitoring: A System's Perspective,
W86-03655 7A

Problems on the Upper Mississippi River and Its Tributaries: Need for a Long-Term Resource Monitoring Program,
W86-03751 7A

MONSOONS
Recent Research on Glaciers on the Chinhai-Tibet Plateau,
W86-03685 2C

MONTANA
Geochemistry and Geohydrology of the West Decker and Big Sky Coal-Mining Areas, Southeastern Montana,
W86-03545 2K

MORAINES
Glaciers and Glaciolithic Systems of the Central Andes,
W86-03675 2C

MULCHING
Mulch Requirements for Erosion Control with the No-Till System in the Tropics: A Review,
W86-03600 4D

MUNICIPAL WASTEWATER
Evaluation of Biological Nitrification-Denitrification at Penticton, British Columbia,
W86-03619 5D

Pilot-Scale Assessment of the Biological Fluidized Bed Process for Municipal Wastewater Treatment,
W86-03631 5D

Proceedings of the 6th Symposium on Wastewater Treatment,
W86-03659 5D

Implementation of Sequencing Batch Reactors for Municipal Wastewater Treatment,
W86-03664 5D

Application of Biological Batch Reactor Technology in Wastewater Treatment,
W86-03665 5D

Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment.
W86-03883 5D

Investigation on the Suitability of Various Pesticide Manufacturing Wastewater for Discharge to Municipal Waste Treatment Facilities,
W86-03900 5D

MUTAGENS
Effect of Soil on the Mutagenic Properties of Waste Water,
W86-03502 5C

Detection and Quantification of Electrophiles in Environmental Samples: Labeling of Potential

Mutagens in Drinking Water by 4-Nitrothiophenol,
W86-03820 5A

NAVIGATION
Influence of Channel Regulating Structures on Fish and Wildlife Habitat: Appendix - Volume I, Figures and Photographs.
W86-03509 6G

Potential Biological Impacts of Navigation Traffic,
W86-03645 6G

Ecological History of the Upper Mississippi River,
W86-03738 6G

Role of Contaminants in the Decline of the Illinois River: Implications for the Upper Mississippi,
W86-03739 6G

Investigation of Effects of Navigation Traffic Activities on Hydrologic, Hydraulic, and Geomorphic Characteristics in the Upper Mississippi River System,
W86-03750 5B

NAWDEX MEMBERSHIP
Directory of Member Organizations of the National Water Data Exchange (NAWDEX),
W86-03557 10D

NEPAL
Glacier Inventory in the Dudh Kosi Region, East Nepal,
W86-03682 2C

NETWORK DESIGN
Some Critical Issues with Monitoring Crystalline Rock Aquifers for Groundwater Management in Rural Areas,
W86-03567 2F

Appraisal of Sediment Transport Measurement in Ghanaian Rivers,
W86-03586 7A

Evaluating Changes in Dike Field Fishes with Community Information Indices,
W86-03628 7A

Water Quality Monitoring: A System's Perspective,
W86-03655 7A

Problems on the Upper Mississippi River and Its Tributaries: Need for a Long-Term Resource Monitoring Program,
W86-03751 7A

Design of a Hydrochemical Data Collection Programme,
W86-03767 7A

NEW YORK
Chemical and Microbiological Monitoring of a Sole-Source Aquifer Intended for Artificial Recharge, Nassau County, New York,
W86-03527 5A

Streamflow Augmentation at Fosters Brook, Long Island, New York - A Hydraulic Feasibility Study,
W86-03551 4A

NEW ZEALAND
Present and Potential Use of Micro-Hydro-Electric Schemes in Remote Locations,
W86-03505 8A

Glacier Snow Line Variations in the Southern Alps, New Zealand,
W86-03692 2C

NITRATES
Nonpoint Nitrate Pollution of Municipal Water Supply Sources: Issues of Analysis and Control,
W86-03649 5G

Effects of Regional Water Management on N-Pollution in Areas with Intensive Agriculture,
W86-03650 5G

Hydrogeological Aspects of Groundwater Nitrification,
W86-03651 5B

Impact of Nitrogen Fertilizer Application on the Nitrate Concentration in Groundwater: Cost-Benefit Analysis Considerations,
W86-03652 5G

Possibilities of Controlling Nitrate Concentrations in Drinking Water,
W86-03653 5G

Possibilities of Water Management for Protecting and Treating Drinking Water Resources in Case of Nitrate Pollution,
W86-03654 5G

Nitrate Pollution of Groundwater Resources: Mechanisms and Modelling,
W86-03656 5B

Modelling Nitrate Pollution in Water Resource Systems: The Thames Nitrate Project,
W86-03657 5G

Integrated Physical-Economic Systems Analysis of Irrigated Agriculture,
W86-03658 5G

Separation of Runoff Components by NO3-N Loading and Estimation of Runoff Loading by Each Component,
W86-03788 5B

NITRIFICATION
Evaluation of Biological Nitrification-Denitrification at Penticton, British Columbia,
W86-03619 5D

Combined Nitrogen and Phosphorus Removal from Wastewaters,
W86-03844 5D

NITROGEN
Separation of Runoff Components by NO3-N Loading and Estimation of Runoff Loading by Each Component,
W86-03788 5B

NITROGEN COMPOUNDS
Evaluation of Selected One-Dimensional Stream Water-Quality Models with Field Data,
W86-03644 5B

Water Chemistry at Selected Sites on Pools 7 and 8 of the Upper Mississippi River: A Ten-Year Survey,
W86-03749 5B

Hydrochemical Budgets of Some Dutch Woodland Soils with High Inputs of Atmospheric Acid Deposition: Mobilization of Aluminum,
W86-03774 5B

Aerobic Transformation of Nitrogenous Substances in a Freshwater Ecosystem,
W86-03782 5C

NITROGEN FIXATION
Nitrogen Fixation and Phytoplankton Interactions in Southwestern Reservoirs,
W86-03720 2H

NITROPHENOLS
High-Performance Liquid Chromatographic Analysis of Nitrophenols,
W86-03814 5A

NITROSAMINES
High-Performance Liquid Chromatographic Determination of Nitrosamines in Water and Wastewater,
W86-03818 5A

NONPOINT POLLUTION SOURCES
Control of Non-Point Nutrient Caused Algal Problems Especially by Dilution,
W86-03488 5G

Nonpoint Nitrate Pollution of Municipal Water Supply Sources: Issues of Analysis and Control,
W86-03649 5G

Effects of Regional Water Management on N-Pollution in Areas with Intensive Agriculture,
W86-03650 5G

Hydrogeological Aspects of Groundwater Nitrification,
W86-03651 5B

Impact of Nitrogen Fertilizer Application on the Nitrate Concentration in Groundwater: Cost-Benefit Analysis Considerations,
W86-03652 5G

Possibilities of Controlling Nitrate Concentrations in Drinking Water,
W86-03653 5G

Possibilities of Water Management for Protecting and Treating Drinking Water Resources in Case of Nitrate Pollution,
W86-03654 5G

Water Quality Monitoring: A System's Perspective,
W86-03655 7A

Nitrate Pollution of Groundwater Resources: Mechanisms and Modelling,
W86-03656 5B

Integrated Physical-Economic Systems Analysis of Irrigated Agriculture,
W86-03658 5G

Use of Continuous Simulation Model Calibration Techniques to Develop Nonpoint Pollution Loading Factors,
W86-03828 5B

Predictive Model for Highway Runoff Pollutant Concentrations and Loadings,
W86-03834 2A

Desk Top Methodology for Nonpoint Source Load Evaluation,
W86-03836 5B

Atmospheric Pollution in Relation to Storm Water Quality Modelling: Literature Review for an Industrial City,
W86-03838 5B

NUISANCE ALGAE
Review of Control Measures for Objectional Algal 'Blooms',
W86-03484 5G

Algal Control through Trophic-Level Interactions: A Subtropical Persepctive,
W86-03490 5G

Cyanophages: Are They Potential Biological Control Agents of Nuisance Blue-Green Algae,
W86-03492 2H

NUMERICAL ANALYSIS
Carbon Dioxide in the Soil Atmosphere: Simulation Model Parameter Estimation from Field Measurements,
W86-03755 2G

NUTRIENT REMOVAL
State-of-the-Art Summary of Phosphorus Inactivation as a Lake Restoration Technique,
W86-03486 5G

Pilot-Scale Evaluation of the Nutrient Film Technique for Wastewater Treatment,
W86-03515 5D

Publications of the Water Research Institute, 58.
W86-03842 5D

Combined Nitrogen and Phosphorus Removal from Wastewaters,
W86-03844 5D

NUTRIENTS
Large-Scale Operations Management Test of Use of the White Amur for Control of Problem Aquatic Plants, Report 2: First Year Poststocking Results,
W86-03454 2H

Comparison of Methods for Estimating Nutrient Release from Lake Sediments,
W86-03477 5B

Control of Non-Point Nutrient Caused Algal Problems Especially by Dilution,
W86-03488 5G

Dissolved Organic Matter and Lake Metabolism: Biogeochemistry and Controls of Nutrient Flux Dynamics in Lakes,
W86-03504 2H

Measurement of Soil Loss from Experimental Basins in Malawi,
W86-03590 2J

Phytoplankton-Environmental Interactions in Reservoirs: Volume 1.
W86-03716 2H

Phytoplankton-Nutrient Kinetics Mechanisms in Mathematical Simulation Models, with Special Attention to Reservoirs and Impoundments,
W86-03717 2H

Modeling Combined Effects of Environmental Factors on Phytoplankton,
W86-03718 2H

Use and Interpretation of Detailed, Mechanistic Models of Phytoplankton Dynamics,
W86-03719 2H

Nitrogen Fixation and Phytoplankton Interactions in Southwestern Reservoirs,
W86-03720 2H

Phytoplankton Effects of Reservoir Use,
W86-03722 5G

Relationship of Common Phytoplankton Genera to Nutrients in Eastern and Southeastern Lakes,
W86-03725 2H

Measurement of Nutrient Concentrations in Sediment Pore Water Collected by a Dialysis Sampler,
W86-03877 5A

OBSERVATION WELL
Hydrogeologic Data from a Test Well at Kathryn Abbey Hanna Park, City of Jacksonville, Florida,
W86-03555 2F

ODOR-PRODUCING ALGAE
Phytoplankton Effects of Reservoir Use,
W86-03722 5G

OFFSHORE PLATFORMS
Onshore Impacts of Offshore Hydrocarbon Development: Annotated Bibliography,
W86-03620 5C

OGALLALA FORMATION
Geologic and Hydrologic Data from a Test-Drilling Program in the High Plains Areas of South Dakota, 1979-1980,
W86-03558 2F

OIL POLLUTION
Onshore Impacts of Offshore Hydrocarbon Development: Annotated Bibliography,
W86-03620 5C

New Techniques Developed in Japan for Oil Spill Cleanup,
W86-03875 5B

OIL RECOVERY
Evaluation of Oil Skimmers and Pumps,
W86-03625 5G

New Techniques Developed in Japan for Oil Spill Cleanup,
W86-03875 5B

OIL SKIMMERS
Evaluation of Oil Skimmers and Pumps,
W86-03625 5G

OIL SLICKS
Fate of Oil and Dispersant Mixtures in Freshwater,
W86-03637 5B

OIL SPILLS
Canadian Inland Waters: Coastal Environments and the Cleanup of Oil Spills,
W86-03621 5G

Oil Stop Valve: Oil Spill Containment Research and Development Project,
W86-03627 5G

Fate of Oil and Dispersant Mixtures in Freshwater,
W86-03637 5B

Deep-Water Blowout Trajectory Models for the Lancaster Sound Region,
W86-03638 5B

OILY WATER
Wastewater Treatment System for a Lurgi Coal Gasification Plant,
W86-03639 5D

OPERATIONS
Good Process Control: Planning and Implementation,
W86-03735 5D

OREGON
Statistical Summaries of Streamflow Data in Oregon; Volume 1 Eastern Oregon,
W86-03550 2E

ORGANIC ACIDS
Role of Natural Organics on Water Interaction with Soil and Rock,
W86-03754 2K

Model Experimental Study of Hydrochemical Processes in the Saturated Zone,
W86-03785 2K

ORGANIC CARBON
Determination of Carbohydrates and Primary Amines in River Water,
W86-03524 5A

Ultraviolet Multiwavelength Absorbance Measurements for Monitoring Trace Organics in Water,
W86-03525 5A

Development of a TOC/COD Analyzer for Process Applications,
W86-03526 5A

ORGANIC COMPOUNDS
Priority Pollutant Methodology Quality Assurance Review,
W86-03529 5A

Removal of Chemical Carcinogens from Water/Wastewater by Reverse Osmosis,
W86-03536 5D

Lead and Cadmium in Precipitation in the Essex Region of Southwestern Ontario,
W86-03772 5B

Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1.
W86-03791 5A

Validation and Priority Pollutant Analysis,
W86-03792 5A

Master Analytical Scheme: An Overview of Interim Procedures,
W86-03793 5A

Master Analytical Scheme: Development of Effective Techniques for Isolation and Concentration of Organics in Water,
W86-03794 5A

Master Analytical Scheme: An Assessment of Factors Influencing Precision and Accuracy of Gas Chromatography/Mass Spectrometry Data,
W86-03795 5A

Quantitative Aspects of the Master Analytical Scheme for Organics in Water,
W86-03796 5A

Quality of Master Analytical Scheme Data: Purgeables and Volatile Organic Acids,
W86-03797 5A

Determination of Phenolic Water Pollutants by Glass Capillary Gas Chromatography,
W86-03799 5A

Chromatographic Considerations for the Analysis of Acid-Extractable Priority Pollutants,
W86-03800 5A

Part-per-Trillion Analysis of Volatile, Base/Neutral and Acidic Water Contaminants on a Single Fused-Silica Capillary Column,
W86-03801 5A

Analysis of Polychlorinated Biphenyls by Glass Capillary and Packed-Column Chromatography,
W86-03802 5A

High-Resolution Gas Chromatography and Negative Ion Chemical Ionization Mass Spectrometry of Polychlorinated Biphenyls,
W86-03803 5A

Determination of Priority Pollutants in Industrial Wastewaters by Stable-Isotope Dilution Gas Chromatography/Mass Spectrometry,
W86-03804 5A

Stable Activable Tracers for Environmentally Significant Organic Molecules,
W86-03805 5A

Microextraction as an Approach to Analysis for Priority Pollutants in Industrial Wastewater,
W86-03806 5A

Evaluation of the Microextraction Technique to Analyze Organics in Water,
W86-03807 5A

Further Optimization of the Pentane Liquid-Liquid Extraction Method for the Analysis of Trace Organic Compounds in Water,
W86-03808 5A

Extraction of Organic Compounds from Water Using Small Amounts of Solvent,
W86-03809 5A

Anionic and Neutral Organic Components in Water by Anion Exchange,
W86-03810 5A

Thermal Desorption from a XAD-4 Adsorption Substrate for Water Analysis by Capillary Gas Chromatography,
W86-03811 5A

Comparison of Several Methods for Collection and Quantification of Polycyclic Aromatic Hydrocarbons from Aqueous Media,
W86-03812 5A

Anomalous Breakthrough of Benzo(A)Pyrene during Concentration with Amberlite XAD-4 Resin from Aqueous Solutions,
W86-03813 5A

High-Performance Liquid Chromatographic Analysis of Nitrophenols,
W86-03814 5A

Development of Techniques for the Isolation and Identification of Nonvolatile Organics in Drinking Water,
W86-03816 5A

Evaluation of Trace Enrichment Methodology in Conjuction with Reverse-Phase High-Performance Liquid Chromatography for Preconcentration, Separation and Quantification of Trace Non-Volatile Organic Compounds in Aqueous Environmental Samples,
W86-03817 5A

High-Performance Liquid Chromatographic Determination of Nitrosamines in Water and Wastewater,
W86-03818 5A

Developments in the Analysis of Priority Pollutants by Liquid Chromatography/Mass Spectrometry and Immunoassay Procedures,
W86-03819 5A

Determination of Linear Alcohol Ethoxylates in Wastewater and Surface Water,
W86-03821 5A

ORGANIC MATTER

Dissolved Organic Matter and Lake Metabolism: Biogeochemistry and Controls of Nutrient Flux Dynamics in Lakes,
W86-03504 2H

Functional Design of Activated Sludge Process-es,
W86-03670 5D

Size Exclusion, Reverse-Phase and Weak Anion Exchange Chromatography of National Organics in Water,
W86-03815 5A

ORGANIC WASTES

Evaluation of Biological Nitrification-Denitrification at Penticton, British Columbia,
W86-03619 5D

OROGRAPHIC PRECIPITATION

Probable Maximum Precipitation Estimates for the Drainage Above Dewey Dam, Johns Creek, Kentucky,
W86-03503 2B

OROGRAPHY

Present and Late Pleistocene Equilibrium Line Altitudes in the Mt Everest Region - An Application of the Glacier Inventory,
W86-03681 2C

Parameterization of Glacier Equilibrium Line Altitude,
W86-03696 2C

OXIDATION-REDUCTION POTENTIAL

Comparative Study of Sequential Redox Processes in Three British Aquifers,
W86-03758 2F

OXYGEN

Hydrochemical Processes in Groundwater Discharge Areas,
W86-03762 2F

Respiratory Gas Content (O2 and CO2) and Ionic Composition of River Water in the Plain of Alsace (Eastern France),
W86-03763 2F

OXYGEN DEPLETION

Comparative Study of Sequential Redox Processes in Three British Aquifers,
W86-03758 2F

OXYGEN ISOTOPES

Surface and Groundwater Mixing and Identification of Local Recharge-Discharge Zones from Seasonal Fluctuations of Oxygen-18 in Groundwater in Fissured Rock,
W86-03790 2F

OXYGEN TRANSFER

Comparative Study of Sequential Redox Processes in Three British Aquifers,
W86-03758 2F

OZONATION

Review of the Use of Ozone for Improving Combined Municipal/Industrial Wastewater Treatment,
W86-03894 5D

PARTICLE SIZE

Filtrable Solids as a Design Parameter for Wastewater Treatment Processes,
W86-03662 5D

Computation of Fractional Removal of Discrete and Flocculant Particles in Settling Basins,
W86-03667 5D

PATH OF POLLUTANTS

Identification and Evaluation of Fundamental Transport and Transformation Process Models,
W86-03422 5B

Evaluative Model for Estimating Environmental Fate,
W86-03424 5B

Fate and Transport Modeling for Toxic Substances,
W86-03425 5B

Simplified Model of the Fate of Partitioning Chemicals in Lakes and Streams,
W86-03426 5B

Hydrologic Transport Modeling,
W86-03427 5B

Modeling Chemical Reactions and Transport in Groundwater Systems: A Review,
W86-03428 5B

Testing Models of the Fate of Chemicals in Aquatic Environments,
W86-03430 5B

Field Validation and Error Analysis of Chemical Fate Models,
W86-03431 5B

Field Validation of Exposure Analysis Modeling System (EXAMS) in a Flowing Stream,
W86-03432 5B

Assessment of Transport and Fate of Toxic Materials in an Experimental Stream Ecosystem,
W86-03433 5B

Fate of Oil and Dispersant Mixtures in Freshwater,
W86-03637 5B

Deep-Water Blowout Trajectory Models for the Lancaster Sound Region,
W86-03638 5B

Nitrate Pollution of Groundwater Resources: Mechanisms and Modelling,
W86-03656 5B

PEAT BOGS

Changes in Ground-Water Chemical Composition in Drained Peat Bogs in Connection with Environmental Protection Measures,
W86-03764 2F

PENNSYLVANIA

Hydrology of Area 1, Eastern Coal Province, Pennsylvania,
W86-03547 2E

PERFORMANCE EVALUATION

Application of Biological Batch Reactor Technology in Wastewater Treatment,
W86-03665 5D

Slime Growth on Fine Bubble Diffusers,
W86-03672 5D

PERMEABILITY

Consequence Assessment of Hydrological Communications through Borehole Plugs,
W86-03629 5G

PERMSELECTIVE MEMBRANES

Development of Ethanol-Selective Membranes,
W86-03617 5D

PESTICIDE KINETICS

User's Manual for the Instream Sediment-Contaminant Transport Model SERATRA,
W86-03630 5B

Mathematical Model, SERATRA, for Sediment-Contaminant Transport in Rivers and Its Application to Pesticide Transport in Four Mile and Wolf Creeks in Iowa,
W86-03648 5B

PESTICIDES

Fate and Transport Modeling for Toxic Substances,
W86-03425 5B

Polychlorinated Biphenyls and Organochlorine Insecticides in Great Blue Heron and Great Egret Eggs from the Upper Mississippi River,
W86-03747 5B

Development of Methods for Pesticides in Wastewater: Applicability of a General Approach,
W86-03798 5A

Anionic and Neutral Organic Components in Water by Anion Exchange,
W86-03810 5A

Investigation on the Suitability of Various Pesticide Manufacturing Wastewater for Discharge to Municipal Waste Treatment Facilities,
W86-03900 5D

PHENOLIC COMPOUNDS

Determination of Phenolic Water Pollutants by Glass Capillary Gas Chromatography,
W86-03799 5A

Chromatographic Considerations for the Analysis of Acid-Extractable Priority Pollutants,
W86-03800 5A

High-Performance Liquid Chromatographic Analysis of Nitrophenols,
W86-03814 5A

PHOSPHATES
Role of Bottom Sediments in Modifying Soluble Phosphate Loads to a Dendritic, Hypertrophic Reservoir,
W86-03787 2J

PHOSPHORUS
Chemical and Physical Properties of Connecticut Lakes,
W86-03438 2H

Large-Scale Operations Management Test of Use of the White Amur for Control of Problem Aquatic Plants, Report 2: First Year Poststocking Results,
W86-03454 2H

Effect of Light Attenuation on the Relationship of Phytoplankton Biomass to Phosphorus Levels,
W86-03726 2H

Mass-Balance Approach to the Understanding of Geochemical Processes in Aqueous Systems,
W86-03773 5B

Erosion of Agricultural Land - A Growing Water Quality Problem in Rural Areas,
W86-03780 5B

Role of Bottom Sediments in Modifying Soluble Phosphate Loads to a Dendritic, Hypertrophic Reservoir,
W86-03787 2J

PHOSPHORUS REMOVAL
State-of-the-Art Summary of Phosphorus Inactivation as a Lake Restoration Technique,
W86-03486 5G

Implementation of Sequencing Batch Reactors for Municipal Wastewater Treatment,
W86-03664 5D

Alkalinity Feed Forward Control of Alum Addition in Wastewater Treatment,
W86-03666 5D

Pollution Control: The Hidden Profit Centre,
W86-03671 5D

PHOTOSYNTHESIS
DCMU-Enhanced Chlorophyll Fluorescence as an Indication of the Physiological Status of Reservoir Phytoplankton: An Initial Evaluation,
W86-03721 2H

PHYSICOCHEMICAL PROPERTIES
Simulation of Physicochemical Interactions in a Water-Rock System in Assessing Ground-Water Quality,
W86-03759 2K

Physico-Chemical Characteristics of Surface Waters and Hydrological Behavior of a Small Granitic Basin (Vosges Massif, France): Annual and Daily Variations,
W86-03775 5B

PHYTOPLANKTON
Phytoplankton-Environmental Interactions in Reservoirs: Volume 1.
W86-03716 2H

Phytoplankton-Nutrient Kinetics Mechanisms in Mathematical Simulation Models, with Special Attention to Reservoirs and Impoundments,
W86-03717 2H

Modeling Combined Effects of Environmental Factors on Phytoplankton,
W86-03718 2H

Use and Interpretation of Detailed, Mechanistic Models of Phytoplankton Dynamics,
W86-03719 2H

Nitrogen Fixation and Phytoplankton Interactions in Southwestern Reservoirs,
W86-03720 2H

DCMU-Enhanced Chlorophyll Fluorescence as an Indication of the Physiological Status of Reservoir Phytoplankton: An Initial Evaluation,
W86-03721 2H

Use of Bioassay Approaches for Assessing Phytoplankton Growth in Lakes and Reservoirs,
W86-03723 5C

Relationship of Common Dominant Phytoplankton to Water Temperature and Season,
W86-03724 2H

Relationship of Common Phytoplankton Genera to Nutrients in Eastern and Southeastern Lakes,
W86-03725 2H

Effect of Light Attenuation on the Relationship of Phytoplankton Biomass to Phosphorus Levels,
W86-03726 2H

PHYTOTOXICITY
Extracellular Metabolite Involvement in Plankton Community Structure,
W86-03491 2H

PIEZOMETERS
Groundwater Quality Evolution in the Upper Aquifer of the Coastal Dune Area of the Western Netherlands,
W86-03761 2F

PILOT PLANTS
Polysar Biological Oxidation Treatment Plant,
W86-03660 5D

PINELANDS NATIONAL RESERVE
Ecological Solutions to Environmental Management Concerns in the Pinelands National Reserve: Proceedins of a Conference,
W86-03616 2L

PLANNING
Dirty Devil Project: Class II Cultral Resources Inventory in Central Utah,
W86-03518 6G

Onshore Impacts of Offshore Hydrocarbon Development: Annotated Bibliography,
W86-03620 5C

Problems on the Upper Mississippi River and Its Tributaries: Need for a Long-Term Resource Monitoring Program,
W86-03751 7A

Design of a Hydrochemical Data Collection Programme,
W86-03767 7A

PLANT GROWTH
Pilot-Scale Evaluation of the Nutrient Film Technique for Wastewater Treatment,
W86-03515 5D

POLICY MAKING
Levee Policy for the National Flood Insurance Program,
W86-03622 6F

POLLUTANT IDENTIFICATION
Studies on Analytical Method of Acrylamide Monomer and Accumulation into Fish,
W86-03466 5B

Chemistry in Water Reuse: Volume 1,
W86-03520 5D

Control and Measurement of Organic Micropollutants in South African Water Reclamation Plants,
W86-03522 5A

Gross Organics Measurements for Monitoring of Wastewater Treatment and Reuse,
W86-03523 5A

Determination of Carbohydrates and Primary Amines in River Water,
W86-03524 5A

Ultraviolet Multiwavelength Absorbance Measurements for Monitoring Trace Organics in Water,
W86-03525 5A

Development of a TOC/COD Analyzer for Process Applications,
W86-03526 5A

Chemical and Microbiological Monitoring of a Sole-Source Aquifer Intended for Artificial Recharge, Nassau County, New York,
W86-03527 5A

Quality Assurance for Water and Wastewater Analyses,
W86-03528 5A

Priority Pollutant Methodology Quality Assurance Review,
W86-03529 5A

Quality Assurance in the Evaluation of Pollution Control Technology: Experiences at the Industrial Environmental Research Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio,
W86-03530 5A

Use of Log-Normal Statistics in Environmental Monitoring,
W86-03531 7C

Biological Evaluation of Methods for the Determination of Free Available Chlorine,
W86-03539 5A

Chlorine Dioxide Chemistry: Generation and Residual Analysis,
W86-03540 5F

Determination of Chlorine Dioxide,
W86-03541 5A

Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1.
W86-03791 5A

Validation and Priority Pollutant Analysis,
W86-03792 5A

Master Analytical Scheme: An Overview of Interim Procedures,
W86-03793 5A

Master Analytical Scheme: Development of Effective Techniques for Isolation and Concentration of Organics in Water,
W86-03794 5A

Master Analytical Scheme: An Assessment of Factors Influencing Precision and Accuracy of Gas Chromatography/Mass Spectrometry Data,
W86-03795 5A

Quantitative Aspects of the Master Analytical Scheme for Organics in Water,
W86-03796 5A

Quality of Master Analytical Scheme Data: Purgeables and Volatile Organic Acids,
W86-03797 5A

Development of Methods for Pesticides in Wastewater: Applicability of a General Approach,
W86-03798 5A

Determination of Phenolic Water Pollutants by Glass Capillary Gas Chromatography,
W86-03799 5A

Chromatographic Considerations for the Analysis of Acid-Extractable Priority Pollutants,
W86-03800 5A

Part-per-Trillion Analysis of Volatile, Base/Neutral and Acidic Water Contaminants on a Single Fused-Silica Capillary Column,
W86-03801 5A

Analysis of Polychlorinated Biphenyls by Glass Capillary and Packed-Column Chromatography,
W86-03802 5A

High-Resolution Gas Chromatography and Negative Ion Chemical Ionization Mass Spectrometry of Polychlorinated Biphenyls,
W86-03803 5A

Determination of Priority Pollutants in Industrial Wastewaters by Stable-Isotope Dilution Gas Chromatography/Mass Spectrometry,
W86-03804 5A

Stable Activable Tracers for Environmentally Significant Organic Molecules,
W86-03805 5A

Microextraction as an Approach to Analysis for Priority Pollutants in Industrial Wastewater,
W86-03806 5A

Evaluation of the Microextraction Technique to Analyze Organics in Water,
W86-03807 5A

Further Optimization of the Pentane Liquid-Liquid Extraction Method for the Analysis of Trace Organic Compounds in Water,
W86-03808 5A

Extraction of Organic Compounds from Water Using Small Amounts of Solvent,
W86-03809 5A

Anionic and Neutral Organic Components in Water by Anion Exchange,
W86-03810 5A

Thermal Desorption from a XAD-4 Adsorption Substrate for Water Analysis by Capillary Gas Chromatography,
W86-03811 5A

Comparison of Several Methods for Collection and Quantification of Polycyclic Aromatic Hydrocarbons from Aqueous Media,
W86-03812 5A

Anomalous Breakthrough of Benzo(A)Pyrene during Concentration with Amberlite XAD-4 Resin from Aqueous Solutions,
W86-03813 5A

High-Performance Liquid Chromatographic Analysis of Nitrophenols,
W86-03814 5A

Size Exclusion, Reverse-Phase and Weak Anion Exchange Chromatography of National Organics in Water,
W86-03815 5A

Development of Techniques for the Isolation and Identification of Nonvolatile Organics in Drinking Water,
W86-03816 5A

Evaluation of Trace Enrichment Methodology in Conjuction with Reverse-Phase High-Performance Liquid Chromatography for Preconcentration, Separation and Quantification of Trace Non-Volatile Organic Compounds in Aqueous Environmental Samples,
W86-03817 5A

High-Performance Liquid Chromatographic Determination of Nitrosamines in Water and Wastewater,
W86-03818 5A

Developments in the Analysis of Priority Pollutants by Liquid Chromatography/Mass Spectrometry and Immunoassay Procedures,
W86-03819 5A

Detection and Quantification of Electrophiles in Environmental Samples: Labeling of Potential Mutagens in Drinking Water by 4-Nitrothiophenol,
W86-03820 5A

Determination of Linear Alcohol Ethoxylates in Wastewater and Surface Water,
W86-03821 5A

POLLUTANTS

Pollutant Transport in Mississippi Sound: Interim Technical Report III,
W86-03839 5B

New Techniques Developed in Japan for Oil Spill Cleanup,
W86-03875 5B

POLLUTION CONTROL

WyCoal Gas Coal-Gasification Project; Preliminary Draft Environmental Impact Statement, Volume 2.
W86-03840 5G

POLLUTION LOAD

Literature Survey of Reservoir Contaminant Problems,
W86-03623 5B

Hydrologic Modeling for Studies of Pollutant Loadings and Transport in Large River Basins,
W86-03827 5A

Predictive Model for Highway Runoff Pollutant Concentrations and Loadings,
W86-03834 2A

POLLUTION (STREAM)

Evaluation of Future Base-Flow Water-Quality Conditions in the Hillsborough River, Florida,
W86-03546 5B

POLYCHLORINATED BIPHENYLS

Polychlorinated Biphenyls (PCBs),
W86-03446 5G

Eco-Kinetic Model for the Accumulation of PCB in Marine Fishes,
W86-03475 5B

Polychlorinated Biphenyls (PCBs) in Common Carp (Cyprinus carpio) of the Upper Mississippi River,
W86-03746 5B

Polychlorinated Biphenyls and Organochlorine Insecticides in Great Blue Heron and Great Egret Eggs from the Upper Mississippi River,
W86-03747 5B

Lead and Cadmium in Precipitation in the Essex Region of Southwestern Ontario,
W86-03772 5B

Analysis of Polychlorinated Biphenyls by Glass Capillary and Packed-Column Chromatography,
W86-03802 5A

High-Resolution Gas Chromatography and Negative Ion Chemical Ionization Mass Spectrometry of Polychlorinated Biphenyls,
W86-03803 5A

POLYCYCLIC AROMATIC HYDROCARBONS

Determination of Polycyclic Aromatic Hydrocarbons in Industrial Discharges and Other Aqueous Effluents,
W86-03506 5A

POLYMERS

Insoluble Polymeric Contact Disinfectants: An Alternative Approach to Water Disinfection,
W86-03543 5F

PONDS

Aquaculture in Dredged Material Containment Areas: Proceedings,
W86-03704 2H

Site Description of Dredged Material Containment Areas: An Overview of Physical, Chemical, Biological Features,
W86-03705 2H

Review of Species Suitable for Containment Site Culture (Fresh Water),
W86-03706 2H

Pond Management: Polyculture vs. Monoculture,
W86-03707 2H

Pond Management: Water Quality Criteria and Control,
W86-03708 5G

Health and Disease Control for Aquatic Animals in Dredged Material Containment Sites,
W86-03709 5C

Pond Design and Management for Coastal Aquaculture,
W86-03710 2H

Mariculture in Old Rice Field Impoundments: An Analogy for Dredged Material Containment Areas,
W86-03711 2L

Selection Criteria and Procedures for Establishing Mariculture Facilities in Existing Containment Sites,
W86-03712 5C

Design Criteria for Aquaculture Ponds on Dredged Material,
W86-03713 8I

Aquaculture and Dredged Material Containment Sites: Significance of Contaminated Sediments,
W86-03714 5B

Legal Environment of a Containment Site: Laws Governing the Acquisition, Maintenance, and Operation of Dredged Material Disposal Sites,
W86-03715 6E

PORE PRESSURE

Comparison of Soil Moisture Characteristics Predicted by the Arya-Paris Model with Laboratory-Measured Data,
W86-03636 2G

POTENTIAL WATER SUPPLY

WATER 2000, Volume V: Water Supply Facility Optimization in Northern New Castle County.
W86-03443 5F

WATER 2000, Volume VI: Forecast of Future Water Demand in New Castle County.
W86-03444 6D

POWERPLANTS

Present and Potential Use of Micro-Hydro-Electric Schemes in Remote Locations,
W86-03505 8A

Oil Stop Valve: Oil Spill Containment Research and Development Project,
W86-03627 5G

PRECIPITATION
Streamflow Summaries from Twelve Tributaries of Farmington Creek, Davis County Experimental Watershed, Northern Utah,
W86-03640 2A

Investigations of Large Scale Storm Systems: Final Report,
W86-03647 2B

Present and Late Pleistocene Equilibrium Line Altitudes in the Mt Everest Region - An Application of the Glacier Inventory,
W86-03681 2C

Lead and Cadmium in Precipitation in the Essex Region of Southwestern Ontario,
W86-03772 5B

Post-Precipitation in Wastewater Treatment,
W86-03845 5D

View on Our Knowledge of Water Resources in Relation to Climate in the Alps,
W86-03847 2B

PRECISION
Assessment of the Measurement Uncertainty in the Estimation of Stream Reaeration Rate Coefficients Using Direct Tracer Techniques,
W86-03824 5A

PRETREATMENT OF WATER
City of Chattanooga Industrial-Municipal Pretreatment Program,
W86-03899 5D

PRIMARY WASTEWATER TREATMENT
Waterloo Clarifier: Principles and Practice,
W86-03663 5D

PROBABILISTIC PROCESS
Data Collection for Hydrochemical Balances: Theoretical Aspects,
W86-03766 2A

PROBABLE MAXIMUM PRECIPITATION
Probable Maximum Precipitation Estimates for the Drainage Above Dewey Dam, Johns Creek, Kentucky,
W86-03503 2B

PROCESS CONTROL
Procedures and Practices in Activated Sludge Process Control.
W86-03727 5D

Correlation of Process Control Strategues with Effluent BOD and Suspended Solids,
W86-03728 5D

Process Control Strategies,
W86-03729 5D

Understanding the Application of Analytical Data to Process Control,
W86-03730 5D

Computerization: Can It Work for You,
W86-03731 5D

Computer as a Tool for Activated Sludge,
W86-03732 5D

Relating BOD5 with On-Line Oxygen Uptake Rate Measurements Using Automatic Respirometers in View of Process Monitoring and Control,
W86-03733 5D

Design of Activated Sludge Facilities for Operating and Maintainability,
W86-03734 5D

Startup Critique of Sartell 3,
W86-03736 5D

PRODUCTIVITY
DCMU-Enhanced Chlorophyll Fluorescence as an Indication of the Physiological Status of Reservoir Phytoplankton: An Initial Evaluation,
W86-03721 2H

PROJECTIONS
Water 2000, Volume IX: Plan Management Summary,
W86-03435 6A

Texas Manufacturing Water Use: Long-Term Projections,
W86-03441 6D

PROTECTION
Final Environmental Impact Statement: Regional Flood Control Tonawanda Creek, Genesee County, New York,
W86-03626 4A

PROTOZOA
Giardiasis in Washington State,
W86-03507 5C

PUBLIC PARTICIPATION
WATER 2000: Conservation Program.
W86-03445 3D

PULP AND PAPER INDUSTRY
Water Recycling in the Pulp and Paper Industry in California,
W86-03437 3E

Startup Critique of Sartell 3,
W86-03736 5D

PULP WASTES
Stripping Kraft Foul Condensates with Waste Gases,
W86-03624 5D

PUMPAGE
WATER 2000, Volume V: Water Supply Facility Optimization in Northern New Castle County.
W86-03443 5F

PUMPS
Solar Powered Groundwater Pumping for Medium Heads,
W86-03583 8C

Evaluation of Oil Skimmers and Pumps,
W86-03625 5G

QUALITY CONTROL
Quality Assurance for Water and Wastewater Analyses,
W86-03528 5A

Priority Pollutant Methodology Quality Assurance Review,
W86-03529 5A

Quality Assurance in the Evaluation of Pollution Control Technology: Experiences at the Industrial Environmental Research Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio,
W86-03530 5A

RADAR
Multi-Parameter Remote Measurement of Rainfall,
W86-03618 2B

RADIOACTIVE TRACERS
Groundwater Quality Evolution in the Upper Aquifer of the Coastal Dune Area of the Western Netherlands,
W86-03761 2F

RADIOACTIVE WASTE DISPOSAL
Consequence Assessment of Hydrological Communications through Borehole Plugs,
W86-03629 5G

RADIOMETRY
Multi-Parameter Remote Measurement of Rainfall,
W86-03618 2B

RAIN
Hydrochemical Relationships Between Rainwater, Floods, Groundwater and Lithology in the Avedat Group on the Negev Highlands, Israel,
W86-03789 2A

RAINFALL
Floods of March 1982, Indiana, Michigan, and Ohio,
W86-03552 2E

Estimating Groundwater Recharge Based on Infiltration Characteristics of Layered Soil,
W86-03566 2F

Continuous Monitoring of Rainfall, Streamflow and Suspended Sediment Concentration in Semiarid Environments,
W86-03591 7B

Multi-Parameter Remote Measurement of Rainfall,
W86-03618 2B

RAINFALL INTENSITY
Hydrometeorological Data Acquisition: Innovative, High-Resolution Programmable Instrumentation for Stormwater Management,
W86-03829 7B

RAINFALL-RUNOFF RELATIONSHIPS
Veld Burning and Sediment Yield from Small Drainage Basins,
W86-03588 4D

Runoff, Erosion and Soil Fertility Restoration on the Mossi Plateau (Central Upper Volta),
W86-03601 4D

Separation of Runoff Components by NO3-N Loading and Estimation of Runoff Loading by Each Component,
W86-03788 5B

RAINFALL SIMULATORS
Evaluation of Factors Influencing Water Erosion in West Africa Using Rainfall Simulation,
W86-03598 2J

REAERATION RATE
Assessment of the Measurement Uncertainty in the Estimation of Stream Reaeration Rate Coefficients Using Direct Tracer Techniques,
W86-03824 5A

RECHARGE
Estimating Groundwater Recharge Based on Infiltration Characteristics of Layered Soil,
W86-03566 2F

Artificial Recharge of Groundwater Resources in Semiarid Regions,
W86-03572 4B

Optimization of Conjunctive Use of Groundwater and Surface Water Resources in the Vaal Basin,
W86-03573 4B

Isotope Studies as a Final Stage in Groundwater Investigations on the African Shield,
W86-03574 2F

Environmental Isotope Hydrology in Southern Africa,
W86-03576 2F

RECREATION
Relationship Between Stream Recreational Use and Stream Characteristics with Implications for Management of Illinois Streams,
W86-03451 5G

Planning Approach for Improved Management of Illinois Streams for Recreation and Conservation,
W86-03452 5G

RECYCLING
Water Recycling in the Pulp and Paper Industry in California,
W86-03437 3E

Evaluation of the Published Literature in the Water Reuse/Recycle Area,
W86-03521 3E

Anaerobic Pretreatment Facility Also Provides Sludge Disposal Capability and Source of Renewable Energy for Food Processor,
W86-03661 5D

REGRESSION ANALYSIS
Conditions and Frequency of Sampling for Elucidations of Transport Mechanisms and Element Budgets in Upland Drainage Basins,
W86-03770 7A

REGULATIONS
Status Report on Compliance with the Chlor-Alkali Mercury Liquid Effluent Regulations 1978-79,
W86-03613 5D

Status Report on Compliance with the Chlor-Alkali Mercury Liquid Effluent Regulations 1980-81,
W86-03633 5E

REMOTE SENSING
Remote Sensing Applications in African Erosion and Sedimentation Studies,
W86-03592 7B

Multi-Parameter Remote Measurement of Rainfall,
W86-03618 2B

Use of Landsat Digital Information for Assessing Glacier Inventory Parameters,
W86-03702 2C

REPTILES
Large-Scale Operations Management Test of Use of the White Amur for Control of Problem Aquatic Plants, Report 1: Baseline Studies, Volume V, The Herpetofauna of Lake Conway, Florida,
W86-03458 2H

RESEARCH FACILITIES
Joint Hydrogeological Surveys,
W86-03579 6E

RESERVOIR OPERATION
Effects of Fluctuating Reservoir Water Levels on Fisheries, Wildlife, and Vegetation: Summary of a Workshop, 24-26 February 1981,
W86-03642 6G

RESERVOIR SILTING
Impact of Sediment on Reservoir Life,
W86-03604 2J

Predicting the Distribution of Depostied Sediment in Southern African Reservoirs,
W86-03605 2J

Sediment Deposition in Major Reservoirs in the Zambezi Basin,
W86-03606 2J

Sediment Storage Requirements for Reservoirs,
W86-03607 2J

Feasibility of Flushing Sediments through Reservoirs,
W86-03608 2J

RESERVOIRS
Impounded Rivers: Perspectives for Ecological Management,
W86-03516 6G

Literature Survey of Reservoir Contaminant Problems,
W86-03623 5B

Final Environmental Impact Statement: Regional Flood Control Tonawanda Creek, Genesee County, New York,
W86-03626 4A

Stormwater Runoff Treatment by Impoundment: Barrhaven Pilot Study,
W86-03632 5D

Evaluation of Selected One-Dimensional Stream Water-Quality Models with Field Data,
W86-03644 5B

User's Manual for EXPLORE-I: A River Basin Water Quality Model, Hydraulic Module Only,
W86-03646 2A

Phytoplankton-Environmental Interactions in Reservoirs: Volume 1.
W86-03716 2H

Phytoplankton-Nutrient Kinetics Mechanisms in Mathematical Simulation Models, with Special Attention to Reservoirs and Impoundments,
W86-03717 2H

Modeling Combined Effects of Environmental Factors on Phytoplankton,
W86-03718 2H

Use and Interpretation of Detailed, Mechanistic Models of Phytoplankton Dynamics,
W86-03719 2H

Nitrogen Fixation and Phytoplankton Interactions in Southwestern Reservoirs,
W86-03720 2H

DCMU-Enhanced Chlorophyll Fluorescence as an Indication of the Physiological Status of Reservoir Phytoplankton: An Initial Evaluation,
W86-03721 2H

Phytoplankton Effects of Reservoir Use,
W86-03722 5G

Use of Bioassay Approaches for Assessing Phytoplankton Growth in Lakes and Reservoirs,
W86-03723 5C

Relationship of Common Dominant Phytoplankton to Water Temperature and Season,
W86-03724 2H

Effect of Light Attenuation on the Relationship of Phytoplankton Biomass to Phosphorus Levels,
W86-03726 2H

Role of Bottom Sediments in Modifying Soluble Phosphate Loads to a Dendritic, Hypertrophic Reservoir,
W86-03787 2J

RESINS
Thermal Desorption from a XAD-4 Adsorption Substrate for Water Analysis by Capillary Gas Chromatography,
W86-03811 5A

Anomalous Breakthrough of Benzo(A)Pyrene during Concentration with Amberlite XAD-4 Resin from Aqueous Solutions,
W86-03813 5A

High-Performance Liquid Chromatographic Analysis of Nitrophenols,
W86-03814 5A

RESOURCES MANAGEMENT
Design of a Hydrochemical Data Collection Programme,
W86-03767 7A

Comparison of Effectiveness of Management Options for Wetland Loss in the Coastal Zone of Louisiana,
W86-03866 2L

RESPIRATION
Carbon Dioxide in the Soil Atmosphere: Simulation Model Parameter Estimation from Field Measurements,
W86-03755 2G

RESPIROMETERS
Relating BOD5 with On-Line Oxygen Uptake Rate Measurements Using Automatic Respirometers in View of Process Monitoring and Control,
W86-03733 5D

REVIEWS
Groundwater Contamination and Emergency Response Guide,
W86-03457 5G

RHIZOSPHERE
Pilot-Scale Evaluation of the Nutrient Film Technique for Wastewater Treatment,
W86-03515 5D

RICE
Rice Herbicides: Molinate (Ordram) and Thiobencarb (Bolero),
W86-03447 5G

RIVER BASINS
Induced Change and Its Impact on Aquatic Community Quality in the Sangamon River Basin of Illinois,
W86-03453 5G

Distribution and Relative Abundance of Fishes in Wisconsin; V: Grant and Platte, Coon and Bad Axe, and LaCrosse River Basins,
W86-03501 6G

Application Guide for Hydrological Simulation Program: FORTRAN (HSPF),
W86-03614 2A

User's Manual for EXPLORE-I: A River Basin Water Quality Model, Hydraulic Module Only,
W86-03646 2A

Geochemical Studies in the Drainage Basin of the Rio Vouga (Portugal). I. General Hydrogeochemistry from Its Origin to the Ria de Aveiro,
W86-03776 2K

RIVER FORECASTING
Evaluation of Future Base-Flow Water-Quality Conditions in the Hillsborough River, Florida,
W86-03546 5B

RIVERS
Human Adaptation Along the Columbia River 4700-1600 BP.: A Report of Test Excavation at River Mile 590, North Central Washington,
W86-03460 6E

Impounded Rivers: Perspectives for Ecological Management,
W86-03516 6G

Sediment Yields of African Rivers,
W86-03584 2J

Evaluation of Selected One-Dimensional Stream Water-Quality Models with Field Data,
W86-03644 5B

Study of the Hydrochemical Regime and Its Long-Term Variations in the Case of Some Rivers in U.S.S.R.,
W86-03778 2K

Study of Anthropogenic Influence on Water Quality in Some Rivers of the Baltic Sea Basin,
W86-03779 5B

ROCK GLACIERS
Rock Glaciers: Glacial and Non-Glacial Origins,
W86-03698 2C

ROCKS
Comparative Study of Sequential Redox Processes in Three British Aquifers,
W86-03758 2F

Hydrochemical Relationships Between Rainwater, Floods, Groundwater and Lithology in the Avedat Group on the Negev Highlands, Israel,
W86-03789 2A

RUNOFF
Accumulation and Transport of Water and Solutes in the Saturated and Unsaturated Zones,
W86-03784 2F

Separation of Runoff Components by NO3-N Loading and Estimation of Runoff Loading by Each Component,
W86-03788 5B

RUNOFF FORECASTING
Desk Top Methodology for Nonpoint Source Load Evaluation,
W86-03836 5B

Applied Climatology.
W86-03846 2B

Discharge Forecasting from Glacierized Areas to Optimize Hydroelectric Power Management,
W86-03848 8C

RUNOFF VOLUME
Stormwater Runoff Treatment by Impoundment: Barrhaven Pilot Study,
W86-03632 5D

SALINE WATER
Saline Groundwater Discharges from Crystalline Rocks Near Thunder Bay, Ontario, Canada,
W86-03786 2F

SALINE WATER INTRUSION
Inland Travel of Tide-Driven Saline Water in the Altamaha and Satilla Rivers, Georgia, and the St. Marys River, Georgia-Florida,
W86-03561 2L

SALINITY
Saline Groundwater Discharges from Crystalline Rocks Near Thunder Bay, Ontario, Canada,
W86-03786 2F

SALINITY CURRENTS
Verification of the Chesapeake Bay Model: Chesapeake Bay Hydraulic Model Investigation,
W86-03459 2L

SALT PONDS
Dirty Devil Project: Class II Cultral Resources Inventory in Central Utah,
W86-03518 6G

SALTS
Saline Groundwater Discharges from Crystalline Rocks Near Thunder Bay, Ontario, Canada,
W86-03786 2F

SAMPLING
Evaluating Changes in Dike Field Fishes with Community Information Indices,
W86-03628 7A

Water Quality Monitoring: A System's Perspective,
W86-03655 7A

SAND FILTERS
Rapid Filtration as a Supplementary Treatment of Domestic Sewage,
W86-03843 5D

SATELLITE TECHNOLOGY
Remote Sensing Applications in African Erosion and Sedimentation Studies,
W86-03592 7B

Some Problems of Glacier Inventory in the Himalayas,
W86-03680 2C

Recent Secular Variations of Snow and Sea Ice Cover,
W86-03695 2C

Use of Landsat Digital Information for Assessing Glacier Inventory Parameters,
W86-03702 2C

Satellite Image Atlas of Glaciers,
W86-03703 2C

SATURATED ZONE
Accumulation and Transport of Water and Solutes in the Saturated and Unsaturated Zones,
W86-03784 2F

Model Experimental Study of Hydrochemical Processes in the Saturated Zone,
W86-03785 2K

SEA ICE
Recent Secular Variations of Snow and Sea Ice Cover,
W86-03695 2C

SEA LEVEL
Mudflat and Marsh Progradation Along Louisiana's Chenier Plain: A Natural Reversal in Coastal Erosion,
W86-03853 2J

Future Sea Level Changes Along the Louisiana Coast,
W86-03862 2L

Reversal of Coastal Erosion by Rapid Sedimentation: The Atchafalaya Delta (South-Central Louisiana),
W86-03865 2J

SEASONAL VARIATION
Relationship of Common Dominant Phytoplankton to Water Temperature and Season,
W86-03724 2H

Respiratory Gas Content (O2 and CO2) and Ionic Composition of River Water in the Plain of Alsace (Eastern France),
W86-03763 2F

Conditions and Frequency of Sampling for Elucidations of Transport Mechanisms and Element Budgets in Upland Drainage Basins,
W86-03770 7A

Physico-Chemical Characteristics of Surface Waters and Hydrological Behavior of a Small Granitic Basin (Vosges Massif, France): Annual and Daily Variations,
W86-03775 5B

Study of the Hydrochemical Regime and Its Long-Term Variations in the Case of Some Rivers in U.S.S.R.,
W86-03778 2K

Study of Anthropogenic Influence on Water Quality in Some Rivers of the Baltic Sea Basin,
W86-03779 5B

Surface and Groundwater Mixing and Identification of Local Recharge-Discharge Zones from Seasonal Fluctuations of Oxygen-18 in Groundwater in Fissured Rock,
W86-03790 2F

SECONDARY RECOVERY
Investigation of the Feasibility of Secondary Recovery of Ground Water from the Ogallala Aquifer: A Report to the Sixty-Eighth Legislature.
W86-03442 3B

SEDIMENT CONCENTRATIONS
Pollutant Transport in Mississippi Sound: Interim Technical Report III,
W86-03839 5B

SEDIMENT CONTROL
Sediment Yield Estimation and the Design of Sediment Control Structures in Rural Africa,
W86-03595 4D

Surface Erosion and Sediment Control at Open-Cast Mines in Southern Africa,
W86-03602 4D

Sediment Storage Requirements for Reservoirs,
W86-03607 2J

Feasibility of Flushing Sediments through Reservoirs,
W86-03608 2J

Anti-Turbidity Overflow System (ATOS) Used for Reducing the Dispersion of Fine Sediments from a Dredge Plane,
W86-03874 5E

SEDIMENT DISCHARGE
Impact of Sediment on Reservoir Life,
W86-03604 2J

SEDIMENT TRANSPORT
Simulation of Estuarine Silt Transport According to Storm Water Runoff,
W86-03465 2J

Sediment Yields of African Rivers,
W86-03584 2J

Rates of Erosion and Sediment Yield in the African Environment,
W86-03585 2J

Appraisal of Sediment Transport Measurement in Ghanaian Rivers,
W86-03586 7A

Suspended Sediment Transport Measurement in Lesotho,
W86-03587 2J

Predicting the Sediment Capacity of a Channel,
W86-03594 2J

User's Manual for the Instream Sediment-Contaminant Transport Model SERATRA,
W86-03630 5B

Mathematical Model, SERATRA, for Sediment-Contaminant Transport in Rivers and Its Application to Pesticide Transport in Four Mile and Wolf Creeks in Iowa,
W86-03648 5B

Sediments of the Upper Mississippi River: Their Sources, Distribution, and Characteristics,
W86-03740 2J

SEDIMENT-WATER INTERFACES
Boundary Conditions of Sediment Surfaces Viewed from DO Behavior,
W86-03467 2H

Interaction Water-Silicate Minerals in the Unsaturated Zone Controlled by Thermodynamic Disequilibria,
W86-03756 2K

SEDIMENT YIELD
Sediment Yields of African Rivers,
W86-03584 2J

Rates of Erosion and Sediment Yield in the African Environment,
W86-03585 2J

Appraisal of Sediment Transport Measurement in Ghanaian Rivers,
W86-03586 7A

Veld Burning and Sediment Yield from Small Drainage Basins,
W86-03588 4D

Sediment Yield Estimation and the Design of Sediment Control Structures in Rural Africa,
W86-03595 4D

Surface Erosion and Sediment Control at Open-Cast Mines in Southern Africa,
W86-03602 4D

SEDIMENTATION
Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium,
W86-03562 2F

Remote Sensing Applications in African Erosion and Sedimentation Studies,
W86-03592 7B

Impact of Sediment on Reservoir Life,
W86-03604 2J

Predicting the Distribution of Depostied Sediment in Southern African Reservoirs,
W86-03605 2J

Sediment Deposition in Major Reservoirs in the Zambezi Basin,
W86-03606 2J

Sediment Storage Requirements for Reservoirs,
W86-03607 2J

Feasibility of Flushing Sediments through Reservoirs,
W86-03608 2J

Potential Biological Impacts of Navigation Traffic,
W86-03645 6G

Filtrable Solids as a Design Parameter for Wastewater Treatment Processes,
W86-03662 5D

Mudflat and Marsh Progradation Along Louisiana's Chenier Plain: A Natural Reversal in Coastal Erosion,
W86-03853 2J

Reversal of Coastal Erosion by Rapid Sedimentation: The Atchafalaya Delta (South-Central Louisiana),
W86-03865 2J

Dispersion of Sediment Resuspension Caused by Dredge Operation,
W86-03873 5B

Rehabilitation of Estuaries in Tsu-Matsusaka Harbor,
W86-03880 5G

SEDIMENTATION BASINS
Separation of Boundary Layer and Flow Turbulence of Center-Feed Circular Sedimentation Basins,
W86-03830 5D

SEDIMENTATION RATES
Recent Rates of Sedimentation in the Mississippi River,
W86-03741 2J

SEDIMENTOLOGY
Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium.
W86-03753 5B

SEDIMENTS
Management of Bottom Sediments Containing Toxic Sustances: Proceedings of the 8th U.S./ Japan Experts Meeting,
W86-03461 5G

Removal of Bottom Sediments in Osaka Port by the Pneuma Pump Dredge 'Shunkai',
W86-03463 5G

Capping of Dredged Material Disposal Management for New York Harbor,
W86-03464 5G

Specialized Dredges Designed for Bottom Sediment Dredging,
W86-03469 5G

Performance Tests of Pneuma Dredge Pump,
W86-03470 5G

Bottom Sediment Dredge 'Clean Up' - Principle and Results -,
W86-03471 5G

Overview of Corps Research Program on Dredging Contaminated Sediments,
W86-03472 5G

Field Dredging Test of Soft Mud Layer by a Front-Open Type Drag Head,
W86-03473 5G

Comparison of Methods for Estimating Nutrient Release from Lake Sediments,
W86-03477 5B

Aquaculture and Dredged Material Containment Sites: Significance of Contaminated Sediments,
W86-03714 5B

Contaminants in the Upper Mississippi River: Proceedings of the 15th Annual Meeting of the Mississippi River Research Consortium.
W86-03737 6G

Distribution and Enrichment of Trace Metals (Cd, Cr, Cu, Ni, Pb, Zn) in Bottom Sediments of Navigation Pools 4 (Lake Pepin), 5 and 9 of the Upper Mississippi River,
W86-03742 5B

Longitudinal Distribution of Trace Elements (As, Cd, Cr, Hg, Pb, and Se) in Fishes and Sediments in the Upper Mississippi River,
W86-03743 5B

Heavy Metal Accumulation in Selected Sessile Components of Fountain City Bay, Pool 5A, of the Upper Mississippi River,
W86-03744 5B

Investigation of Effects of Navigation Traffic Activities on Hydrologic, Hydraulic, and Geomorphic Characteristics in the Upper Mississippi River System,
W86-03750 5B

Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/ Japan Experts Meeting.
W86-03867 5G

Hypolimnetic Oxygen Deficit in a Eutrophic Lake and the Role of Sediment Oxygen Demand,
W86-03869 5C

SEEPAGE
Streamflow Augmentation at Fosters Brook, Long Island, New York - A Hydraulic Feasibility Study,
W86-03551 4A

SEMIARID LANDS
Continuous Monitoring of Rainfall, Streamflow and Suspended Sediment Concentration in Semiarid Environments,
W86-03591 7B

SEMIPERMEABLE MEMBRANES
Preparation of Ion-Exchange Membranes with Extremely Low Areal Resistances,
W86-03615 3A

SENSITIVITY ANALYSIS
Nonlinear Programming Model of a Wastewater Treatment System: Sensitivity Analysis and a Robustness Constraint,
W86-03511 5D

SEPARATION TECHNIQUES
Characteristics and Treatability of Urban Runoff Residuals,
W86-03508 5B

Waterloo Clarifier: Principles and Practice,
W86-03663 5D

Implementation of Sequencing Batch Reactors for Municipal Wastewater Treatment,
W86-03664 5D

Use of Different Physical Separation Techniques for Trace Element Speciation Studies in Natural Waters,
W86-03771 2K

SEQUENCING BATCH REACTORS
Implementation of Sequencing Batch Reactors for Municipal Wastewater Treatment,
W86-03664 5D

SETTLING VELOCITY
Computation of Fractional Removal of Discrete and Flocculant Particles in Settling Basins,
W86-03667 5D

SHORE PROTECTION
Canadian Inland Waters: Coastal Environments and the Cleanup of Oil Spills,
W86-03621 5G

SILICA
Interaction Water-Silicate Minerals in the Unsaturated Zone Controlled by Thermodynamic Disequilibria,
W86-03756 2K

SILICATES
Interaction Water-Silicate Minerals in the Unsaturated Zone Controlled by Thermodynamic Disequilibria,
W86-03756 2K

SILTING
Impact of Sediment on Reservoir Life,
W86-03604 2J

Predicting the Distribution of Depostied Sediment in Southern African Reservoirs,
W86-03605 2J

Sediment Deposition in Major Reservoirs in the Zambezi Basin,
W86-03606 2J

Sediment Storage Requirements for Reservoirs,
W86-03607 2J

Feasibility of Flushing Sediments through Reservoirs,
W86-03608 2J

SIMULATION ANALYSIS
Large-Scale Operations Management Test of Use of the White Amur for Control of Problem Aquatic Plants, Report 2: First Year Poststocking Results,
W86-03454 2H

SIMULATION ANALYSIS

Application Guide for Hydrological Simulation Program: FORTRAN (HSPF),
W86-03614 2A

Mathematical Model, SERATRA, for Sediment-Contaminant Transport in Rivers and Its Application to Pesticide Transport in Four Mile and Wolf Creeks in Iowa,
W86-03648 5B

Simulation of Physicochemical Interactions in a Water-Rock System in Assessing Ground-Water Quality,
W86-03759 2K

Role of Bottom Sediments in Modifying Soluble Phosphate Loads to a Dendritic, Hypertrophic Reservoir,
W86-03787 2J

Continuous DO Response Predicted Using CSPSS Is Verified for Springfield, Missouri,
W86-03826 5B

Chimney Hill Off-Site Drainage Study,
W86-03835 2A

Continuous Simulation of Instream Fecal Coliform Bacteria,
W86-03837 5B

SLIME
Slime Growth on Fine Bubble Diffusers,
W86-03672 5D

SLOPES
Predicting the Sediment Capacity of a Channel,
W86-03594 2J

SLUDGE
Utilization of Sewage Sludges on Cropland,
W86-03897 5E

SLUDGE BED
Use of Aquatic Macrophytes for Sludge Treatment,
W86-03669 5D

SLUDGE DISPOSAL
Sludge and the Land: The Role of Soil and Water Conservation Districts in Land Application of Sewage Sludge.
W86-03514 5E

Final Environmental Impact Statement for Sludge Disposal for the Des Moines Integrated Community Area,
W86-03635 5E

Proceedings of the 6th Symposium on Wastewater Treatment,
W86-03659 5D

SLUDGE DRYING
Use of Aquatic Macrophytes for Sludge Treatment,
W86-03669 5D

Mechanical Dewatering of Dredged Slurries,
W86-03872 5D

SLUDGE THICKENING
Use of Aquatic Macrophytes for Sludge Treatment,
W86-03669 5D

Pollution Control: The Hidden Profit Centre,
W86-03671 5D

SLUDGE UTILIZATION
Sludge and the Land: The Role of Soil and Water Conservation Districts in Land Application of Sewage Sludge.
W86-03514 5E

Proceedings of the 6th Symposium on Wastewater Treatment,
W86-03659 5D

Anaerobic Pretreatment Facility Also Provides Sludge Disposal Capability and Source of Renewable Energy for Food Processor,
W86-03661 5D

Pollution Control: The Hidden Profit Centre,
W86-03671 5D

SNOW COVER
Recent Secular Variations of Snow and Sea Ice Cover,
W86-03695 2C

SNOWLINE
East-West and North-South Snow Line Gradients in the Northern Patagonian Andes, Argentina,
W86-03674 2C

Present and Late Pleistocene Equilibrium Line Altitudes in the Mt Everest Region - An Application of the Glacier Inventory,
W86-03681 2C

Mountain Glaciers in the Mediterranean Area and in Africa,
W86-03691 2C

Glacier Snow Line Variations in the Southern Alps, New Zealand,
W86-03692 2C

SNOWMELT
Floods of March 1982, Indiana, Michigan, and Ohio,
W86-03552 2E

Discharge Forecasting from Glacierized Areas to Optimize Hydroelectric Power Management,
W86-03848 8C

SOIL COMPACTION
Comparison of Soil Moisture Characteristics Predicted by the Arya-Paris Model with Laboratory-Measured Data,
W86-03636 2G

SOIL CONSERVATION
Veld Burning and Sediment Yield from Small Drainage Basins,
W86-03588 4D

Measurement of Soil Loss from Experimental Basins in Malawi,
W86-03590 2J

Evaluation of Factors Influencing Water Erosion in West Africa Using Rainfall Simulation,
W86-03598 2J

Mulch Requirements for Erosion Control with the No-Till System in the Tropics: A Review,
W86-03600 4D

Runoff, Erosion and Soil Fertility Restoration on the Mossi Plateau (Central Upper Volta),
W86-03601 4D

Surface Erosion and Sediment Control at Open-Cast Mines in Southern Africa,
W86-03602 4D

Indigenous Soil Conservation Studies in Sierra Leone,
W86-03603 4D

SOIL ENVIRONMENT
Carbon Dioxide in the Soil Atmosphere: Simulation Model Parameter Estimation from Field Measurements,
W86-03755 2G

SOIL EROSION
Instrumentation and Methods Evaluations for Shallow Land Burial of Waste Materials: Water Erosion,
W86-03510 5E

Measurement of Soil Loss from Experimental Basins in Malawi,
W86-03590 2J

Some Methods for Evaluating Soil Erosion Risk,
W86-03593 2J

Testing the Applicability of a Soil Erodibility Nomogram for Some Tropical Soils,
W86-03599 2J

Erosion of Agricultural Land - A Growing Water Quality Problem in Rural Areas,
W86-03780 5B

SOIL GASES
Carbon Dioxide in the Soil Atmosphere: Simulation Model Parameter Estimation from Field Measurements,
W86-03755 2G

SOIL LOSS
Sheet Erosion from Arable Lands in Zimbabwe: Prediction and Control,
W86-03596 2J

Approach to Testing the USLE Factor Values in Kenya,
W86-03597 2J

Evaluation of Factors Influencing Water Erosion in West Africa Using Rainfall Simulation,
W86-03598 2J

Runoff, Erosion and Soil Fertility Restoration on the Mossi Plateau (Central Upper Volta),
W86-03601 4D

Surface Erosion and Sediment Control at Open-Cast Mines in Southern Africa,
W86-03602 4D

Indigenous Soil Conservation Studies in Sierra Leone,
W86-03603 4D

SOIL TYPES
Transport of Contaminants from Energy Process Waste Leachates through Subsurface Soils and Soil Components Laboratory Experiments,
W86-03500 5B

SOIL WATER
Comparison of Soil Moisture Characteristics Predicted by the Arya-Paris Model with Laboratory-Measured Data,
W86-03636 2G

Role of Natural Organics on Water Interaction with Soil and Rock,
W86-03754 2K

SOLAR ENERGY
Solar Powered Groundwater Pumping for Medium Heads,
W86-03583 8C

SOLAR RADIATION
Use of Solar Energy for Combined Municipal-Industrial Wastewater Treatment,
W86-03895 5D

SOLUTE TRANSPORT
Stochastic-Convective Ensemble Method for Representing Dispersive Transport in Groundwater,
W86-03498 5B

Results of a Solute Transport Experiment at Uvas Creek, September 1972,
W86-03556 2E

Nitrate Pollution of Groundwater Resources: Mechanisms and Modelling,
W86-03656 5B

Accumulation and Transport of Water and Solutes in the Saturated and Unsaturated Zones,
W86-03784 2F

SOUTH AFRICA
Control and Measurement of Organic Micropollutants in South African Water Reclamation Plants,
W86-03522 5A

SOUTH DAKOTA
Geologic and Hydrologic Data from a Test-Drilling Program in the High Plains Areas of South Dakota, 1979-1980,
W86-03558 2F

SPECIES COMPOSITION
Evaluation of Community Information Indices for Mississippi River Fisheries,
W86-03499 7C

Evaluating Changes in Dike Field Fishes with Community Information Indices,
W86-03628 7A

SPECIES DIVERSITY
Limits to the Control of Algal Populations by Grazing Zooplankton: The Environmental Theater and the Ecological Play,
W86-03489 5G

Evaluation of Community Information Indices for Mississippi River Fisheries,
W86-03499 7C

SPECIFIC CONDUCTIVITY
Inland Travel of Tide-Driven Saline Water in the Altamaha and Satilla Rivers, Georgia, and the St. Marys River, Georgia-Florida,
W86-03561 2L

SPRING TIDES
Inland Travel of Tide-Driven Saline Water in the Altamaha and Satilla Rivers, Georgia, and the St. Marys River, Georgia-Florida,
W86-03561 2L

SPRINGS
Hydrochemistry of Springs from Dolomite Reefs in the Southern Alps of Northern Italy,
W86-03765 2K

STANDARDS
Establishment of an Ammonia Effluent Limitation for the Twin Cities Metro Plant,
W86-03748 5B

STATISTICAL ANALYSES
Statistical Summaries of Streamflow Data in Oregon; Volume 1 Eastern Oregon,
W86-03550 2E

STATISTICAL ANALYSIS
Use of Log-Normal Statistics in Environmental Monitoring,
W86-03531 7C

Effect of Topographic Orientation on the Variations of Glacier Length,
W86-03700 2C

Data Collection for Hydrochemical Balances: Theoretical Aspects,
W86-03766 2A

Temporal Changes in Ground Water Quality in the Phreatic Zone Uttar Pradesh (India) and Their Impact on Sampling Schedule,
W86-03768 2F

STATISTICAL METHODS
Study of Anthropogenic Influence on Water Quality in Some Rivers of the Baltic Sea Basin,
W86-03779 5B

STOCHASTIC PROCESS
Stochastic-Convective Ensemble Method for Representing Dispersive Transport in Groundwater,
W86-03498 5B

STORM MORPHOLOGY
Investigations of Large Scale Storm Systems: Final Report,
W86-03647 2B

STORM RUNOFF
Characteristics and Treatability of Urban Runoff Residuals,
W86-03508 5B

Stormwater Runoff Treatment by Impoundment: Barrhaven Pilot Study,
W86-03632 5D

Conditions and Frequency of Sampling for Elucidations of Transport Mechanisms and Element Budgets in Upland Drainage Basins,
W86-03770 7A

Separation of Runoff Components by NO3-N Loading and Estimation of Runoff Loading by Each Component,
W86-03788 5B

Improved Surcharge Computation, in EXTRAN,
W86-03832 3A

Chimney Hill Off-Site Drainage Study,
W86-03835 2A

STORM SEEPAGE
Separation of Runoff Components by NO3-N Loading and Estimation of Runoff Loading by Each Component,
W86-03788 5B

STORM SEWERS
Control of Non-Point Nutrient Caused Algal Problems Especially by Dilution,
W86-03488 5G

STORM WASTEWATER
Characteristics and Treatability of Urban Runoff Residuals,
W86-03508 5B

Continuous DO Response Predicted Using CSPSS Is Verified for Springfield, Missouri,
W86-03826 5B

STORM WATER
Stormwater Runoff Treatment by Impoundment: Barrhaven Pilot Study,
W86-03632 5D

Preparing a Design Storm,
W86-03833 2A

STORMWATER
Oil Stop Valve: Oil Spill Containment Research and Development Project,
W86-03627 5G

STORMWATER MANAGEMENT
Hydrometeorological Data Acquisition: Innovative, High-Resolution Programmable Instrumentation for Stormwater Management,
W86-03829 7B

STRATIFICATION
Boundary Conditions of Sediment Surfaces Viewed from DO Behavior,
W86-03467 2H

STREAM FISHERIES
Evaluation of Community Information Indices for Mississippi River Fisheries,
W86-03499 7C

STREAM IMPROVEMENT
Final Environmental Impact Statement: Regional Flood Control Tonawanda Creek, Genesee County, New York,
W86-03626 4A

STREAM POLLUTION
Water Quality and Water Pollution Problems on the Indian Sub-Continent,
W86-03781 5B

Aerobic Transformation of Nitrogenous Substances in a Freshwater Ecosystem,
W86-03782 5C

STREAM PROFILES
Relationship Between Stream Recreational Use and Stream Characteristics with Implications for Management of Illinois Streams,
W86-03451 5G

STREAMFLOW
Statistical Summaries of Streamflow Data in Oregon; Volume 1 Eastern Oregon,
W86-03550 2E

Streamflow Augmentation at Fosters Brook, Long Island, New York - A Hydraulic Feasibility Study,
W86-03551 4A

Continuous Monitoring of Rainfall, Streamflow and Suspended Sediment Concentration in Semi-arid Environments,
W86-03591 7B

Streamflow Summaries from Twelve Tributaries of Farmington Creek, Davis County Experimental Watershed, Northern Utah,
W86-03640 2A

STREAMFLOW VELOCITY
Time of Travel and Dispersion of Solutes in a 36.4-Mile Reach of the North Platte River Downstream from Casper, Wyoming,
W86-03559 2E

STREAMS
Relationship Between Stream Recreational Use and Stream Characteristics with Implications for Management of Illinois Streams,
W86-03451 5G

Planning Approach for Improved Management of Illinois Streams for Recreation and Conservation,
W86-03452 5G

Floods of March 1982, Indiana, Michigan, and Ohio,
W86-03552 2E

Physico-Chemical Characteristics of Surface Waters and Hydrological Behavior of a Small Granitic Basin (Vosges Massif, France): Annual and Daily Variations,
W86-03775 5B

STRIP MINE WASTES
Geochemistry and Geohydrology of the West Decker and Big Sky Coal-Mining Areas, Southeastern Montana,
W86-03545 2K

STRUCTURAL ENGINEERING
Revetment Stability Study, Fort Fisher State Historic Site, North Carolina: Hydraulic Model Investigation,
W86-03479 8A

SUBSURFACE INVESTIGATIONS
Hydrogeologic Data from a Test Well at Kathryn Abbey Hanna Park, City of Jacksonville, Florida,
W86-03555 2F

SUBSURFACE WATER
Military Hydrology; Report 3: A Review of Army Doctrine on Military Hydrology,
W86-03456 10F

Hydrogeological Aspects of Groundwater Nitrification,
W86-03651 5B

Evaluation of the Intensity of Some Recent Exogenic Geological Processes in the U.S.S.R. by the Hydrogeochemical Balances Method,
W86-03777 2K

SULFATES
Hydrochemical Budgets of Some Dutch Woodland Soils with High Inputs of Atmospheric Acid Deposition: Mobilization of Aluminum,
W86-03774 5B

Post-Precipitation in Wastewater Treatment,
W86-03845 5D

SURFACE-GROUNDWATER RELATIONS
Hydrochemical Processes in Groundwater Discharge Areas,
W86-03762 2F

Hydrochemical Budgeting in Studies of Ground-Water Renewability in Areas of Glacial Formation Systems,
W86-03783 2F

Accumulation and Transport of Water and Solutes in the Saturated and Unsaturated Zones,
W86-03784 2F

Surface and Groundwater Mixing and Identification of Local Recharge-Discharge Zones from Seasonal Fluctuations of Oxygen-18 in Groundwater in Fissured Rock,
W86-03790 2F

SURFACE-GROUNDWATER RELATIONSHIPS
Streamflow Augmentation at Fosters Brook, Long Island, New York - A Hydraulic Feasibility Study,
W86-03551 4A

SURFACE RUNOFF
Floods of March 1982, Indiana, Michigan, and Ohio,
W86-03552 2E

Erosion of Agricultural Land - A Growing Water Quality Problem in Rural Areas,
W86-03780 5B

Separation of Runoff Components by NO3-N Loading and Estimation of Runoff Loading by Each Component,
W86-03788 5B

SURFACE WATER
Military Hydrology; Report 3: A Review of Army Doctrine on Military Hydrology,
W86-03456 10F

Determination of Polycyclic Aromatic Hydrocarbons in Industrial Discharges and Other Aqueous Effluents,
W86-03506 5A

Water Resources Data, Colorado, Water Year 1981; Volume 3: Dolores River Basin, Green River Basin, and San Juan River Basin.
W86-03609 2E

Water Resource Data and Trend Analysis for the Blue Creek Watershed Project, Pike County, Illinois: Phase II,
W86-03610 5G

SURFACTANTS
Determination of Linear Alcohol Ethoxylates in Wastewater and Surface Water,
W86-03821 5A

SURVEYS
Corpus Christi Inner Harbor Water Quality Survey, August 1982,
W86-03440 5B

Distribution and Relative Abundance of Fishes in Wisconsin; V: Grant and Platte, Coon and Bad Axe, and LaCrosse River Basins,
W86-03501 6G

Joint Hydrogeological Surveys,
W86-03579 6E

SUSPENDED SEDIMENT
Sediment Yields of African Rivers,
W86-03584 2J

SUSPENDED SEDIMENTS
Overview of Corps Research Program on Dredging Contaminated Sediments,
W86-03472 5G

Suspended Sediment Transport Measurement in Lesotho,
W86-03587 2J

Continuous Monitoring of Rainfall, Streamflow and Suspended Sediment Concentration in Semi-arid Environments,
W86-03591 7B

SUSPENDED SOLIDS
Dissolved Air Flotation for Primary and Secondary Clarification,
W86-03611 5D

Filtrable Solids as a Design Parameter for Wastewater Treatment Processes,
W86-03662 5D

Waterloo Clarifier: Principles and Practice,
W86-03663 5D

Application of Biological Batch Reactor Technology in Wastewater Treatment,
W86-03665 5D

Computation of Fractional Removal of Discrete and Flocculant Particles in Settling Basins,
W86-03667 5D

SWAMPS
Changes in Ground-Water Chemical Composition in Drained Peat Bogs in Connection with Environmental Protection Measures,
W86-03764 2F

SWIMMING POOLS
Pollution in Swimming Pool Water,
W86-03544 5B

SWITZERLAND
Some Comments on the Swiss Glacier Inventory,
W86-03690 2C

SYMPOSIUM
Proceedings of the 6th Symposium on Wastewater Treatment,
W86-03659 5D

SYNTHETIC HYDROLOGY
Preparing a Design Storm,
W86-03833 2A

TALUS
Rock Glaciers: Glacial and Non-Glacial Origins,
W86-03698 2C

TASTE
Phytoplankton Effects of Reservoir Use,
W86-03722 5G

TEMPERATURE
Relationship of Common Dominant Phytoplankton to Water Temperature and Season,
W86-03724 2H

TEMPORAL DISTRIBUTION
Carbon Dioxide in the Soil Atmosphere: Simulation Model Parameter Estimation from Field Measurements,
W86-03755 2G

Temporal Changes in Ground Water Quality in the Phreatic Zone Uttar Pradesh (India) and Their Impact on Sampling Schedule,
W86-03768 2F

TENNESSEE
Ground Water in Carbonate Rocks and Regolith in the Fairview Area, Tennessee,
W86-03548 2F

Drought-Related Impacts on Municipal and Major Self-Supplied Industrial Water Withdrawals in Tennessee, (Part A and Part B),
W86-03560 6D

TERRAIN ANALYSIS
Probable Maximum Precipitation Estimates for the Drainage Above Dewey Dam, Johns Creek, Kentucky,
W86-03503 2B

TEXAS
Ground-Water Conditions of the Triassic Aquifer in Deaf Smith and Swisher Counties,
W86-03439 2F

Corpus Christi Inner Harbor Water Quality Survey, August 1982,
W86-03440 5B

Texas Manufacturing Water Use: Long-Term Projections,
W86-03441 6D

Effects of Coastal Structures on Shoreline Stabilization and Land Loss - The Texas Experience,
W86-03863 2L

TEXTILE MILL WASTES
Hyperfiltration of Textile Process Water for Reuse,
W86-03535 5D

THEORETICAL ANALYSIS
Computation of Fractional Removal of Discrete and Flocculant Particles in Settling Basins,
W86-03667 5D

Simulation of Physicochemical Interactions in a Water-Rock System in Assessing Ground-Water Quality,
W86-03759 2K

Data Collection for Hydrochemical Balances: Theoretical Aspects,
W86-03766 2A

Reliability of Information in Hydrogeochemical Investigations,
W86-03769 7A

THERMODYNAMICS
Interaction Water-Silicate Minerals in the Unsaturated Zone Controlled by Thermodynamic Disequilibria,
W86-03756 2K

Simulation of Physicochemical Interactions in a Water-Rock System in Assessing Ground-Water Quality,
W86-03759 2K

Some Implication of the Role of Kinetics in Enhancing Element Transport,
W86-03760 2K

Reliability of Information in Hydrogeochemical Investigations,
W86-03769 7A

THESAURI
Aquaculture Thesaurus: Descriptors Used in the National Aquaculture Information System,
W86-03643 10C

THIOCARBAMATE PESTICIDES
Rice Herbicides: Molinate (Ordram) and Thiobencarb (Bolero),
W86-03447 5G

TIDAL HYDRAULICS
Verification of the Chesapeake Bay Model: Chesapeake Bay Hydraulic Model Investigation,
W86-03459 2L

TIDAL RIVERS
Inland Travel of Tide-Driven Saline Water in the Altamaha and Satilla Rivers, Georgia, and the St. Marys River, Georgia-Florida,
W86-03561 2L

TIDES
Currents in Suisun Bay,
W86-03448 2L

TIME OF TRAVEL
Time of Travel and Dispersion of Solutes in a 36.4-Mile Reach of the North Platte River Downstream from Casper, Wyoming,
W86-03559 2E

TOPOGRAPHY
Effect of Topographic Orientation on the Variations of Glacier Length,
W86-03700 2C

TOXIC WASTES
Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/Japan Experts Meeting.
W86-03867 5G

Aeration Effects on Marine Eutrophication,
W86-03868 5G

Hypolimnetic Oxygen Deficit in a Eutrophic Lake and the Role of Sediment Oxygen Demand,
W86-03869 5C

New Techniques Developed in Japan for Oil Spill Cleanup,
W86-03875 5B

Accumulation of Acrylamide into Fish,
W86-03878 5C

Alternatives to Open Water Disposal of Contaminated Dredged Material,
W86-03879 5E

Rehabilitation of Estuaries in Tsu-Matsusaka Harbor,
W86-03880 5G

TOXICITY
Role of Environmental Transport and Fate Models in Implementing the Toxic Substances Control Act,
W86-03420 5B

Predictive Fate Models: Their Role in the U.S. Environmental Protection Agency's Water Program,
W86-03421 5B

TRACE ELEMENTS
Use of Different Physical Separation Techniques for Trace Element Speciation Studies in Natural Waters,
W86-03771 2K

Geochemical Studies in the Drainage Basin of the Rio Vouga (Portugal). I. General Hydrogeochemistry from Its Origin to the Ria de Aveiro,
W86-03776 2K

TRACERS
Studies on Groundwater Transport in Fractured Crystalline Rock under Controlled Conditions Using Nonradioactive Tracers,
W86-03497 2F

Stable Activable Tracers for Environmentally Significant Organic Molecules,
W86-03805 5A

Assessment of the Measurement Uncertainty in the Estimation of Stream Reaeration Rate Coefficients Using Direct Tracer Techniques,
W86-03824 5A

TRAINING
Polysar Biological Oxidation Treatment Plant,
W86-03660 5D

Good Process Control: Planning and Implementation,
W86-03735 5D

TRAJECTORY MODELS
Deep-Water Blowout Trajectory Models for the Lancaster Sound Region,
W86-03638 5B

TRANSPORTATION
Potential Biological Impacts of Navigation Traffic,
W86-03645 6G

TRICKLING FILTERS
Filtrable Solids as a Design Parameter for Wastewater Treatment Processes,
W86-03662 5D

TRITIUM
Hydrochemical Budgeting in Studies of Groundwater Renewability in Areas of Glacial Formation Systems,
W86-03783 2F

TURBIDITY
Specialized Dredges Designed for Bottom Sediment Dredging,
W86-03469 5G

Bottom Sediment Dredge 'Clean Up' - Principle and Results -,
W86-03471 5G

Anti-Turbidity Overflow System (ATOS) Used for Reducing the Dispersion of Fine Sediments from a Dredge Plane,
W86-03874 5E

TURBULENT FLOW
Deep-Water Blowout Trajectory Models for the Lancaster Sound Region,
W86-03638 5B

Separation of Boundary Layer and Flow Turbulence of Center-Feed Circular Sedimentation Basins,
W86-03830 5D

TURKEY
Present Glaciation in Turkey,
W86-03689 2C

ULTRAFILTRATION
Use of Different Physical Separation Techniques for Trace Element Speciation Studies in Natural Waters,
W86-03771 2K

UNIVERSAL SOIL LOSS EQUATION
Approach to Testing the USLE Factor Values in Kenya,
W86-03597 2J

UNSATURATED ZONE
Accumulation and Transport of Water and Solutes in the Saturated and Unsaturated Zones,
W86-03784 2F

URBAN DRAINAGE
Chimney Hill Off-Site Drainage Study,
W86-03835 2A

URBAN HYDROLOGY
Improved Surcharge Computation, in EXTRAN,
W86-03832 3A

URBAN RUNOFF
Characteristics and Treatability of Urban Runoff Residuals,
W86-03508 5B

Predictive Model for Highway Runoff Pollutant Concentrations and Loadings,
W86-03834 2A

URBANIZATION
Evaluation of Future Base-Flow Water-Quality Conditions in the Hillsborough River, Florida,
W86-03546 5B

USSR
Problems and Results of Studies of Mountain Glaciers in the Soviet Union,
W86-03686 2C

Studies of Glacier Fluctuations in the USSR,
W86-03687 2C

VALVES
Oil Stop Valve: Oil Spill Containment Research and Development Project,
W86-03627 5G

VEGETATION
Veld Burning and Sediment Yield from Small Drainage Basins,
W86-03588 4D

Remote Sensing Applications in African Erosion and Sedimentation Studies,
W86-03592 7B

Mulch Requirements for Erosion Control with the No-Till System in the Tropics: A Review,
W86-03600 4D

Effects of Fluctuating Reservoir Water Levels on Fisheries, Wildlife, and Vegetation: Summary of a Workshop, 24-26 February 1981,
W86-03642 6G

VIRUSES
Cyanophages: Are They Potential Biological Control Agents of Nuisance Blue-Green Algae,
W86-03492 2H

WASHINGTON
Giardiasis in Washington State,
W86-03507 5C

WASTE CHARACTERISTICS
Functional Design of Activated Sludge Processes,
W86-03670 5D

WASTE DISPOSAL
Transport of Contaminants from Energy Process Waste Leachates through Subsurface Soils and Soil Components Laboratory Experiments,
W86-03500 5B

Instrumentation and Methods Evaluations for Shallow Land Burial of Waste Materials: Water Erosion,
W86-03510 5E

Consequence Assessment of Hydrological Communications through Borehole Plugs,
W86-03629 5G

Wastewater Treatment System for a Lurgi Coal Gasification Plant,
W86-03639 5D

WASTE GASES
Stripping Kraft Foul Condensates with Waste Gases,
W86-03624 5D

WASTE MANAGEMENT
Water and Waste Management in the Canadian Meat and Poultry Processing Industry,
W86-03612 5E

WASTE RECOVERY
Status Report on Compliance with the Chlor-Alkali Mercury Liquid Effluent Regulations 1978-79,
W86-03613 5D

Anaerobic Pretreatment Facility Also Provides Sludge Disposal Capability and Source of Renewable Energy for Food Processor,
W86-03661 5D

WASTE TREATMENT
Minimizing Costs by Good Financial Management,
W86-03886 6C

WASTEWATER
Innovation in Wastewater Treatment,
W86-03884 5D

Industrial Categorical Pretreatment Standards,
W86-03885 5D

Minimizing Costs by Good Financial Management,
W86-03886 6C

Compatibility Assessment of Municipal/Industrial Wastewaters for Combined Biological Treatment,
W86-03887 5D

Treatment of Municipal Wastewaters Containing Biologically Hazardous Industrial Compounds by Conventional Activated Sludge and Extended Aeration,
W86-03889 5D

Textile Waste Treatment at a Municipal PACT Facility,
W86-03893 5D

Review of the Use of Ozone for Improving Combined Municipal/Industrial Wastewater Treatment,
W86-03894 5D

Use of Solar Energy for Combined Municipal-Industrial Wastewater Treatment,
W86-03895 5D

Land Treatment of Combined Municipal/Industrial Wastewaters,
W86-03896 5D

Utilization of Sewage Sludges on Cropland,
W86-03897 5E

City of Chattanooga Industrial-Municipal Pretreatment Program,
W86-03899 5D

Investigation on the Suitability of Various Pesticide Manufacturing Wastewater for Discharge to Municipal Waste Treatment Facilities,
W86-03900 5D

WASTEWATER ANALYSIS
Analysis of Chlorinated Organic Compounds Formed During Chlorination of Wastewater Products,
W86-03496 5A

Gross Organics Measurements for Monitoring of Wastewater Treatment and Reuse,
W86-03523 5A

Quality Assurance for Water and Wastewater Analyses,
W86-03528 5A

Priority Pollutant Methodology Quality Assurance Review,
W86-03529 5A

Quality Assurance in the Evaluation of Pollution Control Technology: Experiences at the Industrial Environmental Research Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio,
W86-03530 5A

Relating BOD5 with On-Line Oxygen Uptake Rate Measurements Using Automatic Respirometers in View of Process Monitoring and Control,
W86-03733 5D

Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1.
W86-03791 5A

Development of Methods for Pesticides in Wastewater: Applicability of a General Approach,
W86-03798 5A

Determination of Phenolic Water Pollutants by Glass Capillary Gas Chromatography,
W86-03799 5A

Chromatographic Considerations for the Analysis of Acid-Extractable Priority Pollutants,
W86-03800 5A

Determination of Priority Pollutants in Industrial Wastewaters by Stable-Isotope Dilution Gas Chromatography/Mass Spectrometry,
W86-03804 5A

Microextraction as an Approach to Analysis for Priority Pollutants in Industrial Wastewater,
W86-03806 5A

Evaluation of the Microextraction Technique to Analyze Organics in Water,
W86-03807 5A

WASTEWATER COMPOSITION
Analysis of Chlorinated Organic Compounds Formed During Chlorination of Wastewater Products,
W86-03496 5A

Filtrable Solids as a Design Parameter for Wastewater Treatment Processes,
W86-03662 5D

WASTEWATER DISPOSAL
Effect of Soil on the Mutagenic Properties of Waste Water,
W86-03502 5C

Optimization of Conjunctive Use of Groundwater and Surface Water Resources in the Vaal Basin,
W86-03573 4B

WASTEWATER FACILITIES
Nonlinear Programming Model of a Wastewater Treatment System: Sensitivity Analysis and a Robustness Constraint,
W86-03511 5D

Wastewater Treatment System for a Lurgi Coal Gasification Plant,
W86-03639 5D

Polysar Biological Oxidation Treatment Plant,
W86-03660 5D

Anaerobic Pretreatment Facility Also Provides Sludge Disposal Capability and Source of Renewable Energy for Food Processor,
W86-03661 5D

WASTEWATER RENOVATION
Water Recycling in the Pulp and Paper Industry in California,
W86-03437 3E

Treatment of Combined Industrial and Domestic Wastewater for Reuse in South Africa,
W86-03890 5D

WASTEWATER TREATMENT
Characteristics and Treatability of Urban Runoff Residuals,
W86-03508 5B

Nonlinear Programming Model of a Wastewater Treatment System: Sensitivity Analysis and a Robustness Constraint,
W86-03511 5D

Chemistry in Water Reuse: Volume 1,
W86-03520 5D

Removal of Various Toxic Heavy Metals and Cyanide from Water by Membrane Processes,
W86-03532 5D

Demonstration of a Cross-Flow Microfiltration System from the Removal of Toxic Heavy Metals from Battery Manufacturing Wastewater Effluents,
W86-03533 5D

Coupled Transport Membranes for Removal of Chromium from Electroplating Rinse Solutions,
W86-03534 5D

Hyperfiltration of Textile Process Water for Reuse,
W86-03535 5D

Removal of Chemical Carcinogens from Water/Wastewater by Reverse Osmosis,
W86-03536 5D

Potential of Reverse Osmosis for Recycling and Reuse of Sewage Effluents,
W86-03537 5D

Rational Approaches in the Analysis of Chemical Disinfection Kinetics,
W86-03538 5D

Chlorine Dioxide Chemistry: Generation and Residual Analysis,
W86-03540 5F

Dissolved Air Flotation for Primary and Secondary Clarification,
W86-03611 5D

Final Environmental Impact Statement for Sludge Disposal for the Des Moines Integrated Community Area,
W86-03635 5E

Wastewater Treatment System for a Lurgi Coal Gasification Plant,
W86-03639 5D

Proceedings of the 6th Symposium on Wastewater Treatment,
W86-03659 5D

Polysar Biological Oxidation Treatment Plant,
W86-03660 5D

Anaerobic Pretreatment Facility Also Provides Sludge Disposal Capability and Source of Renewable Energy for Food Processor,
W86-03661 5D

Filtrable Solids as a Design Parameter for Wastewater Treatment Processes,
W86-03662 5D

Waterloo Clarifier: Principles and Practice,
W86-03663 5D

Implementation of Sequencing Batch Reactors for Municipal Wastewater Treatment,
W86-03664 5D

Application of Biological Batch Reactor Technology in Wastewater Treatment,
W86-03665 5D

Alkalinity Feed Forward Control of Alum Addition in Wastewater Treatment,
W86-03666 5D

Computation of Fractional Removal of Discrete and Flocculant Particles in Settling Basins,
W86-03667 5D

Comparison of Stirred Suspension and Fixed Film Anaerobic Digestion Systems,
W86-03668 5D

Use of Aquatic Macrophytes for Sludge Treatment,
W86-03669 5D

Pollution Control: The Hidden Profit Centre,
W86-03671 5D

Slime Growth on Fine Bubble Diffusers,
W86-03672 5D

Procedures and Practices in Activated Sludge Process Control.
W86-03727 5D

Correlation of Process Control Strategues with Effluent BOD and Suspended Solids,
W86-03728 5D

Process Control Strategies,
W86-03729 5D

Understanding the Application of Analytical Data to Process Control,
W86-03730 5D

Computerization: Can It Work for You,
W86-03731 5D

Computer as a Tool for Activated Sludge,
W86-03732 5D

Design of Activated Sludge Facilities for Operating and Maintainability,
W86-03734 5D

Good Process Control: Planning and Implementation,
W86-03735 5D

Startup Critique of Sartell 3,
W86-03736 5D

Establishment of an Ammonia Effluent Limitation for the Twin Cities Metro Plant,
W86-03748 5B

Publications of the Water Research Institute, 58.
W86-03842 5D

Rapid Filtration as a Supplementary Treatment of Domestic Sewage,
W86-03843 5D

Combined Nitrogen and Phosphorus Removal from Wastewaters,
W86-03844 5D

Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment.
W86-03883 5D

Innovation in Wastewater Treatment,
W86-03884 5D

Industrial Categorical Pretreatment Standards,
W86-03885 5D

Minimizing Costs by Good Financial Management,
W86-03886 6C

Compatibility Assessment of Municipal/Industrial Wastewaters for Combined Biological Treatment,
W86-03887 5D

Biological Inhibition Screening of Industrial Wastewaters,
W86-03888 5D

Treatment of Municipal Wastewaters Containing Biologically Hazardous Industrial Compounds by Conventional Activated Sludge and Extended Aeration,
W86-03889 5D

Use of Granular Activated Carbon to Treat Municipal Wastewater Receiving Industrial Flow,
W86-03891 5D

Full Scale Experience with Activated Carbon Treatment of Joint Municipal - Industrial Wastewater,
W86-03892 5D

Textile Waste Treatment at a Municipal PACT Facility,
W86-03893 5D

Review of the Use of Ozone for Improving Combined Municipal/Industrial Wastewater Treatment,
W86-03894 5D

Use of Solar Energy for Combined Municipal-Industrial Wastewater Treatment,
W86-03895 5D

Land Treatment of Combined Municipal/Industrial Wastewaters,
W86-03896 5D

Utilization of Sewage Sludges on Cropland,
W86-03897 5E

City of Chattanooga Industrial-Municipal Pretreatment Program,
W86-03899 5D

Investigation on the Suitability of Various Pesticide Manufacturing Wastewater for Discharge to Municipal Waste Treatment Facilities,
W86-03900 5D

WASTWATER TREATMENT
Stripping Kraft Foul Condensates with Waste Gases,
W86-03624 5D

WATER
Development of Ethanol-Selective Membranes,
W86-03617 5D

WATER ANALYSIS
Hydrochemical and Isotopic Content of Basalt Groundwaters Beneath the Hanford Site, Washington,
W86-03517 2K

Control and Measurement of Organic Micropollutants in South African Water Reclamation Plants,
W86-03522 5A

Gross Organics Measurements for Monitoring of Wastewater Treatment and Reuse,
W86-03523 5A

Ultraviolet Multiwavelength Absorbance Measurements for Monitoring Trace Organics in Water,
W86-03525 5A

Development of a TOC/COD Analyzer for Process Applications,
W86-03526 5A

Chemical and Microbiological Monitoring of a Sole-Source Aquifer Intended for Artificial Recharge, Nassau County, New York,
W86-03527 5A

Quality Assurance for Water and Wastewater Analyses,
W86-03528 5A

Use of Log-Normal Statistics in Environmental Monitoring,
W86-03531 7C

Biological Evaluation of Methods for the Determination of Free Available Chlorine,
W86-03539 5A

Water Quality Monitoring: A System's Perspective,
W86-03655 7A

Use of Bioassay Approaches for Assessing Phytoplankton Growth in Lakes and Reservoirs,
W86-03723 5C

Temporal Changes in Ground Water Quality in the Phreatic Zone Uttar Pradesh (India) and Their Impact on Sampling Schedule,
W86-03768 2F

Use of Different Physical Separation Techniques for Trace Element Speciation Studies in Natural Waters,
W86-03771 2K

Advances in the Identification and Analysis of Organic Pollutants in Water, Volume 1.
W86-03791 5A

Validation and Priority Pollutant Analysis,
W86-03792 5A

Master Analytical Scheme: An Overview of Interim Procedures,
W86-03793 5A

Master Analytical Scheme: Development of Effective Techniques for Isolation and Concentration of Organics in Water,
W86-03794 5A

Master Analytical Scheme: An Assessment of Factors Influencing Precision and Accuracy of Gas Chromatography/Mass Spectrometry Data,
W86-03795 5A

Quantitative Aspects of the Master Analytical Scheme for Organics in Water,
W86-03796 5A

Quality of Master Analytical Scheme Data: Purgeables and Volatile Organic Acids,
W86-03797 5A

Development of Methods for Pesticides in Wastewater: Applicability of a General Approach,
W86-03798 5A

Part-per-Trillion Analysis of Volatile, Base/Neutral and Acidic Water Contaminants on a Single Fused-Silica Capillary Column,
W86-03801 5A

High-Resolution Gas Chromatography and Negative Ion Chemical Ionization Mass Spectrometry of Polychlorinated Biphenyls,
W86-03803 5A

Further Optimization of the Pentane Liquid-Liquid Extraction Method for the Analysis of Trace Organic Compounds in Water,
W86-03808 5A

Extraction of Organic Compounds from Water Using Small Amounts of Solvent,
W86-03809 5A

WATER ANALYSIS

Anionic and Neutral Organic Components in Water by Anion Exchange,
W86-03810 5A

Thermal Desorption from a XAD-4 Adsorption Substrate for Water Analysis by Capillary Gas Chromatography,
W86-03811 5A

Comparison of Several Methods for Collection and Quantification of Polycyclic Aromatic Hydrocarbons from Aqueous Media,
W86-03812 5A

Anomalous Breakthrough of Benzo(A)Pyrene during Concentration with Amberlite XAD-4 Resin from Aqueous Solutions,
W86-03813 5A

High-Performance Liquid Chromatographic Analysis of Nitrophenols,
W86-03814 5A

Size Exclusion, Reverse-Phase and Weak Anion Exchange Chromatography of National Organics in Water,
W86-03815 5A

Development of Techniques for the Isolation and Identification of Nonvolatile Organics in Drinking Water,
W86-03816 5A

Evaluation of Trace Enrichment Methodology in Conjuction with Reverse-Phase High-Performance Liquid Chromatography for Preconcentration, Separation and Quantification of Trace Non-Volatile Organic Compounds in Aqueous Environmental Samples,
W86-03817 5A

High-Performance Liquid Chromatographic Determination of Nitrosamines in Water and Wastewater,
W86-03818 5A

Developments in the Analysis of Priority Pollutants by Liquid Chromatography/Mass Spectrometry and Immunoassay Procedures,
W86-03819 5A

Detection and Quantification of Electrophiles in Environmental Samples: Labeling of Potential Mutagens in Drinking Water by 4-Nitrothiophenol,
W86-03820 5A

Determination of Linear Alcohol Ethoxylates in Wastewater and Surface Water,
W86-03821 5A

WATER CHEMISTRY

Water Chemistry at Selected Sites on Pools 7 and 8 of the Upper Mississippi River: A Ten-Year Survey,
W86-03749 5B

Hydrochemistry of Springs from Dolomite Reefs in the Southern Alps of Northern Italy,
W86-03765 2K

Hydrochemical Budgeting in Studies of Ground-Water Renewability in Areas of Glacial Formation Systems,
W86-03783 2F

WATER CIRCULATION

Aeration/Circulation for Control of Algal Production,
W86-03487 2G

WATER CONSERVATION

Water Recycling in the Pulp and Paper Industry in California,
W86-03437 3E

WATER 2000: Conservation Program.
W86-03445 3D

Evaluation of the Published Literature in the Water Reuse/Recycle Area,
W86-03521 3E

Control and Measurement of Organic Micropollutants in South African Water Reclamation Plants,
W86-03522 5A

Gross Organics Measurements for Monitoring of Wastewater Treatment and Reuse,
W86-03523 5A

Hyperfiltration of Textile Process Water for Reuse,
W86-03535 5D

WATER CURRENTS

Currents in Suisun Bay,
W86-03448 2L

Currents in San Pablo Bay,
W86-03449 2L

WATER DEMAND

WATER 2000, Volume V: Water Supply Facility Optimization in Northern New Castle County.
W86-03443 5F

WATER 2000, Volume VI: Forecast of Future Water Demand in New Castle County.
W86-03444 6D

WATER DISTRIBUTION

WATER 2000, Volume VI: Forecast of Future Water Demand in New Castle County.
W86-03444 6D

WATER LAW

Hydrogeological Data Collection, Storage, Retrieval and Water Law in Botswana,
W86-03580 7C

Legal Environment of a Containment Site: Laws Governing the Acquisition, Maintenance, and Operation of Dredged Material Disposal Sites,
W86-03715 6E

WATER LEVEL

Future Sea Level Changes Along the Louisiana Coast,
W86-03862 2L

WATER LEVEL FLUCTUATIONS

Effects of Fluctuating Reservoir Water Levels on Fisheries, Wildlife, and Vegetation: Summary of a Workshop, 24-26 February 1981,
W86-03642 6G

WATER LEVELS

Geochemistry and Geohydrology of the West Decker and Big Sky Coal-Mining Areas, Southeastern Montana,
W86-03545 2K

WATER MANAGEMENT

Water 2000, Volume IX: Plan Management Summary,
W86-03435 6A

WATER 2000, Volume VI: Forecast of Future Water Demand in New Castle County.
W86-03444 6D

Groundwater Resources in Tropical African Regoliths,
W86-03564 2F

Some Critical Issues with Monitoring Crystalline Rock Aquifers for Groundwater Management in Rural Areas,
W86-03567 2F

Artificial Recharge of Groundwater Resources in Semiarid Regions,
W86-03572 4B

Optimization of Conjunctive Use of Groundwater and Surface Water Resources in the Vaal Basin,
W86-03573 4B

Water and Waste Management in the Canadian Meat and Poultry Processing Industry,
W86-03612 5E

Effects of Regional Water Management on N-Pollution in Areas with Intensive Agriculture,
W86-03650 5G

Possibilities of Water Management for Protecting and Treating Drinking Water Resources in Case of Nitrate Pollution,
W86-03654 5G

WATER POLICY

Joint Hydrogeological Surveys,
W86-03579 6E

WATER POLLUTION

Status Report on Compliance with the Chlor-Alkali Mercury Liquid Effluent Regulations 1978-79,
W86-03613 5D

Water Quality and Water Pollution Problems on the Indian Sub-Continent,
W86-03781 5B

Continuous DO Response Predicted Using CSPSS Is Verified for Springfield, Missouri,
W86-03826 5B

WATER POLLUTION CONTROL

Status Report on Compliance with the Chlor-Alkali Mercury Liquid Effluent Regulations 1978-79,
W86-03613 5D

WyCoal Gas Coal-Gasification Project; Preliminary Draft Environmental Impact Statement, Volume 2.
W86-03840 5G

WATER POLLUTION EFFECTS

Onshore Impacts of Offshore Hydrocarbon Development: Annotated Bibliography,
W86-03620 5C

Health and Disease Control for Aquatic Animals in Dredged Material Containment Sites,
W86-03709 5C

Selection Criteria and Procedures for Establishing Mariculture Facilities in Existing Containment Sites,
W86-03712 5C

Use of Bioassay Approaches for Assessing Phytoplankton Growth in Lakes and Reservoirs,
W86-03723 5C

Role of Contaminants in the Decline of the Illinois River: Implications for the Upper Mississippi,
W86-03739 6G

Water Quality and Water Pollution Problems on the Indian Sub-Continent,
W86-03781 5B

Aerobic Transformation of Nitrogenous Substances in a Freshwater Ecosystem,
W86-03782 5C

WATER POLLUTION PREVENTION

Emergency Response Equipment to Clean Up Hazardous Chemical Releases at Spills and Uncontrolled Waste Sites,
W86-03476 5G

Nonpoint Nitrate Pollution of Municipal Water Supply Sources: Issues of Analysis and Control,
W86-03649 5G

WATER POLLUTION SOURCES

Corpus Christi Inner Harbor Water Quality Survey, August 1982,
W86-03440 5B

Polychlorinated Biphenyls (PCBs),
W86-03446 5G

Determination of Polycyclic Aromatic Hydrocarbons in Industrial Discharges and Other Aqueous Effluents,
W86-03506 5A

Chemical and Microbiological Monitoring of a Sole-Source Aquifer Intended for Artificial Recharge, Nassau County, New York,
W86-03527 5A

Pollution in Swimming Pool Water,
W86-03544 5B

Occurrence and Distribution of Fluoride in Groundwaters of Kenya,
W86-03569 2K

Performance of Sanitary Completion Measures of Wells and Boreholes Used for Rural Water Supplies in Malawi,
W86-03582 5G

Onshore Impacts of Offshore Hydrocarbon Development: Annotated Bibliography,
W86-03620 5C

Potential Biological Impacts of Navigation Traffic,
W86-03645 6G

Establishment of an Ammonia Effluent Limitation for the Twin Cities Metro Plant,
W86-03748 5B

Investigation of Effects of Navigation Traffic Activities on Hydrologic, Hydraulic, and Geomorphic Characteristics in the Upper Mississippi River System,
W86-03750 5B

Erosion of Agricultural Land - A Growing Water Quality Problem in Rural Areas,
W86-03780 5B

Water Quality and Water Pollution Problems on the Indian Sub-Continent,
W86-03781 5B

WATER QUALITY

Ground-Water Conditions of the Triassic Aquifer in Deaf Smith and Swisher Counties,
W86-03439 2F

Corpus Christi Inner Harbor Water Quality Survey, August 1982,
W86-03440 5B

Rice Herbicides: Molinate (Ordram) and Thiobencarb (Bolero),
W86-03447 5G

Report of Analyses for Light Hydrocarbons in Ground Water,
W86-03512 5A

Hydrology and Land Use in Van Buren County, Michigan,
W86-03554 2E

Characteristics of the Weathered Basement Aquifer in Malawi in Relation to Rural Water Supplies,
W86-03568 2F

Occurrence and Distribution of Fluoride in Groundwaters of Kenya,
W86-03569 2K

Electric Logs for Groundwater Exploration in the Niger Delta.
W86-03570 2F

Water Resources Data, Colorado, Water Year 1981; Volume 3: Dolores River Basin, Green River Basin, and San Juan River Basin.
W86-03609 2E

Water Resource Data and Trend Analysis for the Blue Creek Watershed Project, Pike County, Illinois: Phase II,
W86-03610 5G

Application Guide for Hydrological Simulation Program: FORTRAN (HSPF),
W86-03614 2A

Literature Survey of Reservoir Contaminant Problems,
W86-03623 5B

Evaluation of Selected One-Dimensional Stream Water-Quality Models with Field Data,
W86-03644 5B

User's Manual for EXPLORE-I: A River Basin Water Quality Model, Hydraulic Module Only,
W86-03646 2A

Water Quality Monitoring: A System's Perspective,
W86-03655 7A

Health and Disease Control for Aquatic Animals in Dredged Material Containment Sites,
W86-03709 5C

Water Chemistry at Selected Sites on Pools 7 and 8 of the Upper Mississippi River: A Ten-Year Survey,
W86-03749 5B

Simulation of Physicochemical Interactions in a Water-Rock System in Assessing Ground-Water Quality,
W86-03759 2K

Physico-Chemical Characteristics of Surface Waters and Hydrological Behavior of a Small Granitic Basin (Vosges Massif, France): Annual and Daily Variations,
W86-03775 5B

Study of Anthropogenic Influence on Water Quality in Some Rivers of the Baltic Sea Basin,
W86-03779 5B

Erosion of Agricultural Land - A Growing Water Quality Problem in Rural Areas,
W86-03780 5B

Water Quality and Water Pollution Problems on the Indian Sub-Continent,
W86-03781 5B

Accumulation and Transport of Water and Solutes in the Saturated and Unsaturated Zones,
W86-03784 2F

WATER QUALITY CONTROL

Polychlorinated Biphenyls (PCBs),
W86-03446 5G

Rice Herbicides: Molinate (Ordram) and Thiobencarb (Bolero),
W86-03447 5G

Management of Bottom Sediments Containing Toxic Sustances: Proceedings of the 8th U.S./Japan Experts Meeting,
W86-03461 5G

Dredging and Management Problems in Lake Suwa,
W86-03462 5G

Removal of Bottom Sediments in Osaka Port by the Pneuma Pump Dredge 'Shunkai',
W86-03463 5G

Capping of Dredged Material Disposal Management for New York Harbor,
W86-03464 5G

Restoration Study of Dredging in Lake Ksaumigaura,
W86-03468 5G

Specialized Dredges Designed for Bottom Sediment Dredging,
W86-03469 5G

Performance Tests of Pneuma Dredge Pump,
W86-03470 5G

Bottom Sediment Dredge 'Clean Up' - Principle and Results -,
W86-03471 5G

Overview of Corps Research Program on Dredging Contaminated Sediments,
W86-03472 5G

Field Dredging Test of Soft Mud Layer by a Front-Open Type Drag Head,
W86-03473 5G

Overview of a Dredging Demonstration in Contaminated Material, James River, Virginia,
W86-03474 5G

Emergency Response Equipment to Clean Up Hazardous Chemical Releases at Spills and Uncontrolled Waste Sites,
W86-03476 5G

Dirty Devil Project: Class II Cultral Resources Inventory in Central Utah,
W86-03518 6G

Performance of Sanitary Completion Measures of Wells and Boreholes Used for Rural Water Supplies in Malawi,
W86-03582 5G

Canadian Inland Waters: Coastal Environments and the Cleanup of Oil Spills,
W86-03621 5G

Nonpoint Nitrate Pollution of Municipal Water Supply Sources: Issues of Analysis and Control,
W86-03649 5G

Effects of Regional Water Management on N-Pollution in Areas with Intensive Agriculture,
W86-03650 5G

Hydrogeological Aspects of Groundwater Nitrification,
W86-03651 5B

Impact of Nitrogen Fertilizer Application on the Nitrate Concentration in Groundwater: Cost-Benefit Analysis Considerations,
W86-03652 5G

Possibilities of Controlling Nitrate Concentrations in Drinking Water,
W86-03653 5G

Possibilities of Water Management for Protecting and Treating Drinking Water Resources in Case of Nitrate Pollution,
W86-03654 5G

Modelling Nitrate Pollution in Water Resource Systems: The Thames Nitrate Project,
W86-03657 5G

Integrated Physical-Economic Systems Analysis of Irrigated Agriculture,
W86-03658 5G

Pond Management: Water Quality Criteria and Control,
W86-03708 5G

Phytoplankton Effects of Reservoir Use,
W86-03722 5G

WATER QUALITY MANAGEMENT
Proceedings of Workshop on Algal Management and Control,
W86-03483 4A

Aeration/Circulation for Control of Algal Production,
W86-03487 2G

Control of Non-Point Nutrient Caused Algal Problems Especially by Dilution,
W86-03488 5G

Utilization of Bacteria in Managing Cyanobacterial Populations: A Review and Update,
W86-03493 2H

WATER QUALITY STANDARDS
Literature Survey of Reservoir Contaminant Problems,
W86-03623 5B

WATER QUQLITY CONTROL
Oil Stop Valve: Oil Spill Containment Research and Development Project,
W86-03627 5G

WATER REQUIREMENTS
WATER 2000, Volume VI: Forecast of Future Water Demand in New Castle County.
W86-03444 6D

WATER RESOURCES DEVELOPMENT
WATER 2000, Volume V: Water Supply Facility Optimization in Northern New Castle County.
W86-03443 5F

Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium,
W86-03562 2F

African Groundwater Development-The Challenges for Hydrogeological Science,
W86-03563 2F

Groundwater Resources in Tropical African Regoliths,
W86-03564 2F

Character of Fractured Rock Aquifers in Eastern Botswana,
W86-03565 2F

Role of Modeling in the Development of African Groundwater Resources,
W86-03578 2F

Joint Hydrogeological Surveys,
W86-03579 6E

Predicting the Sediment Capacity of a Channel,
W86-03594 2J

Hydrological Basins in West Greenland and Their Relationship to a Preliminary Sectorial Division of the Inland Ice Sheet,
W86-03678 2C

WATER REUSE
Water Recycling in the Pulp and Paper Industry in California,
W86-03437 3E

Chemistry in Water Reuse: Volume 1,
W86-03520 5D

Evaluation of the Published Literature in the Water Reuse/Recycle Area.
W86-03521 3E

Control and Measurement of Organic Micropollutants in South African Water Reclamation Plants,
W86-03522 5A

Chemical and Microbiological Monitoring of a Sole-Source Aquifer Intended for Artificial Recharge, Nassau County, New York,
W86-03527 5A

Potential of Reverse Osmosis for Recycling and Reuse of Sewage Effluents,
W86-03537 5D

Treatment of Combined Industrial and Domestic Wastewater for Reuse in South Africa,
W86-03890 5D

Use of Granular Activated Carbon to Treat Municipal Wastewater Receiving Industrial Flow,
W86-03891 5D

WATER SAMPLING
Temporal Changes in Ground Water Quality in the Phreatic Zone Uttar Pradesh (India) and Their Impact on Sampling Schedule,
W86-03768 2F

Reliability of Information in Hydrogeochemical Investigations,
W86-03769 7A

Conditions and Frequency of Sampling for Elucidations of Transport Mechanisms and Element Budgets in Upland Drainage Basins,
W86-03770 7A

WATER STORAGE
Artificial Recharge of Groundwater Resources in Semiarid Regions,
W86-03572 4B

Optimization of Conjunctive Use of Groundwater and Surface Water Resources in the Vaal Basin,
W86-03573 4B

WATER SUPPLY
Water Recycling in the Pulp and Paper Industry in California,
W86-03437 3E

WATER 2000, Volume V: Water Supply Facility Optimization in Northern New Castle County.
W86-03443 5F

African Groundwater Development-The Challenges for Hydrogeological Science,
W86-03563 2F

Character of Fractured Rock Aquifers in Eastern Botswana,
W86-03565 2F

Characteristics of the Weathered Basement Aquifer in Malawi in Relation to Rural Water Supplies,
W86-03568 2F

Electric Logs for Groundwater Exploration in the Niger Delta.
W86-03570 2F

Performance of Sanitary Completion Measures of Wells and Boreholes Used for Rural Water Supplies in Malawi,
W86-03582 5G

Accumulation and Transport of Water and Solutes in the Saturated and Unsaturated Zones,
W86-03784 2F

WATER TRANSFER
Viability of Interbasin, Interstate/International Transfers of Water,
W86-03436 6D

WATER TREATMENT
Chlorine Dioxide Chemistry: Generation and Residual Analysis,
W86-03540 5F

Reduction of Trihalomethane Production with Optimal Disinfection Through Alternative Disinfection Systems,
W86-03542 5F

Insoluble Polymeric Contact Disinfectants: An Alternative Approach to Water Disinfection,
W86-03543 5F

Dissolved Air Flotation for Primary and Secondary Clarification,
W86-03611 5D

Possibilities of Controlling Nitrate Concentrations in Drinking Water,
W86-03653 5G

Modelling Nitrate Pollution in Water Resource Systems: The Thames Nitrate Project,
W86-03657 5G

Water Pollution: Industry and Government Working Together - A Case Study of Muncie, Indiana's Industrial Pretreatment Program,
W86-03898 5A

WATER TREATMENT FACILITIES
Water Pollution: Industry and Government Working Together - A Case Study of Muncie, Indiana's Industrial Pretreatment Program,
W86-03898 5A

WATER USE
Texas Manufacturing Water Use: Long-Term Projections,
W86-03441 6D

Drought-Related Impacts on Municipal and Major Self-Supplied Industrial Water Withdrawals in Tennessee, (Part A and Part B),
W86-03560 6D

WATER USE EFFICIENCY
Water and Waste Management in the Canadian Meat and Poultry Processing Industry,
W86-03612 5E

WATER UTILIZATION
Hydrology and Land Use in Van Buren County, Michigan,
W86-03554 2E

WATER YIELD
Streamflow Summaries from Twelve Tributaries of Farmington Creek, Davis County Experimental Watershed, Northern Utah,
W86-03640 2A

WATER YIELD IMPROVEMENT
Investigation of the Feasibility of Secondary Recovery of Ground Water from the Ogallala Aquifer: A Report to the Sixty-Eighth Legislature.
W86-03442 3B

WATERSHED MANAGEMENT
Evaluation of Future Base-Flow Water-Quality Conditions in the Hillsborough River, Florida,
W86-03546 5B

WATERSHEDS
Streamflow Summaries from Twelve Tributaries of Farmington Creek, Davis County Experimental Watershed, Northern Utah,
W86-03640 2A

WEATHER DATA COLLECTIONS
Investigations of Large Scale Storm Systems: Final Report,
W86-03647 2B

WEATHER MODIFICATION
SCPP Forecasting Support for the Period 1 December 1978 through 30 September 1984,
W86-03495 3B

WEATHERING
Geochemical Studies in the Drainage Basin of the Rio Vouga (Portugal). I. General Hydrogeochemistry from Its Origin to the Ria de Aveiro,
W86-03776 2K

Evaluation of the Intensity of Some Recent Exogenic Geological Processes in the U.S.S.R. by the Hydrogeochemical Balances Method,
W86-03777 2K

WELL DATA
Ground Water in Carbonate Rocks and Regolith in the Fairview Area, Tennessee,
W86-03548 2F

WELLS
Groundwater Resources in Tropical African Regoliths,
W86-03564 2F

Character of Fractured Rock Aquifers in Eastern Botswana,
W86-03565 2F

Some Critical Issues with Monitoring Crystalline Rock Aquifers for Groundwater Management in Rural Areas,
W86-03567 2F

Characteristics of the Weathered Basement Aquifer in Malawi in Relation to Rural Water Supplies,
W86-03568 2F

Electric Logs for Groundwater Exploration in the Niger Delta.
W86-03570 2F

Performance of Sanitary Completion Measures of Wells and Boreholes Used for Rural Water Supplies in Malawi,
W86-03582 5G

Effects of Regional Water Management on N-Pollution in Areas with Intensive Agriculture,
W86-03650 5G

WETLANDS
Preliminary Guide to the Onsite Identification and Delineation of the Wetlands of the South Atlantic United States,
W86-03480 2H

Preliminary Guide to the Onsite Identification and Delineation of the Wetlands of the Interior United States.
W86-03482 2H

Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options.
W86-03850 2J

Sedimentation and Apparent Sea-Level Rise as Factors Affecting Land Loss in Coastal Louisiana,
W86-03851 2J

Wetland Loss Directly Associated with Canal Dredging in the Louisiana Coastal Zone,
W86-03854 6G

Canals and Wetland Erosion Rates in Coastal Louisiana,
W86-03855 6G

Effect of Coastal Alteration on Marsh Plants,
W86-03856 2L

Effects of Wetland Deterioration on the Fish and Wildlife Resources of Coastal Louisiana,
W86-03857 2L

Some Consequences of Wetland Modification to Louisiana's Fisheries,
W86-03858 2L

Wetland Losses and Coastal Fisheries: An Enigmatic and Economically Significant Dependency,
W86-03859 2L

Legal Implications of Coastal Erosion in Louisiana,
W86-03860 6E

Economic and Cultural Consequences of Land Loss in Louisiana,
W86-03861 6G

Effects of Coastal Structures on Shoreline Stabilization and Land Loss - The Texas Experience,
W86-03863 2L

Comparison of Effectiveness of Management Options for Wetland Loss in the Coastal Zone of Louisiana,
W86-03866 2L

WILDLIFE
Final Environmental Impact Statement: Regional Flood Control Tonawanda Creek, Genesee County, New York,
W86-03626 4A

Effects of Fluctuating Reservoir Water Levels on Fisheries, Wildlife, and Vegetation: Summary of a Workshop, 24-26 February 1981,
W86-03642 6G

Polychlorinated Biphenyls and Organochlorine Insecticides in Great Blue Heron and Great Egret Eggs from the Upper Mississippi River,
W86-03747 5B

WILDLIFE HABITATS
Impacts of Flooding Regime Modification on Wildlife Habitats of Bottomland Hardwood Forests in the Lower Mississippi Valley,
W86-03634 6G

WILLIAMSON COUNTY
Ground Water in Carbonate Rocks and Regolith in the Fairview Area, Tennessee,
W86-03548 2F

WIND VELOCITY
Currents in San Pablo Bay,
W86-03449 2L

WISCONSIN
Distribution and Relative Abundance of Fishes in Wisconsin; V: Grant and Platte, Coon and Bad Axe, and LaCrosse River Basins,
W86-03501 6G

WYOMING
Time of Travel and Dispersion of Solutes in a 36.4-Mile Reach of the North Platte River Downstream from Casper, Wyoming,
W86-03559 2E

ZOOPLANKTON
Limits to the Control of Algal Populations by Grazing Zooplankton: The Environmental Theater and the Ecological Play,
W86-03489 5G

Algal Control through Trophic-Level Interactions: A Subtropical Persepctive,
W86-03490 5G

AUTHOR INDEX

ABRAMS, E. F.
Evaluation of the Published Literature in the Water Reuse/Recycle Area,
W86-03521 3E

ACHER, A. J.
Use of Solar Energy for Combined Municipal-Industrial Wastewater Treatment,
W86-03895 5D

ADDISON, G.
Slime Growth on Fine Bubble Diffusers,
W86-03672 5D

AGRAWAL, S. K.
Computation of Fractional Removal of Discrete and Flocculant Particles in Settling Basins,
W86-03667 5D

AIETA, E. M.
Chlorine Dioxide Chemistry: Generation and Residual Analysis,
W86-03540 5F

AKABANE, M.
Dredging and Management Problems in Lake Suwa,
W86-03462 5G

AKRASI, S. A.
Appraisal of Sediment Transport Measurement in Ghanaian Rivers,
W86-03586 7A

ALDRICH, J. A.
Improved Surcharge Computation, in EXTRAN,
W86-03832 3A

ALEXANDER, F. M.
Drought-Related Impacts on Municipal and Major Self-Supplied Industrial Water Withdrawals in Tennessee, (Part A and Part B),
W86-03560 6D

ALFOLDI, L.
Hydrogeological Aspects of Groundwater Nitrification,
W86-03651 5B

ALFORD, A. L.
Master Analytical Scheme: An Overview of Interim Procedures,
W86-03793 5A

ALON, N. C.
Mariculture in Old Rice Field Impoundments: An Analogy for Dredged Material Containment Areas,
W86-03711 2L

ALVAREZ, R.
Glacier Inventory of Bolivia,
W86-03676 2C

AMBROISE, B.
Physico-Chemical Characteristics of Surface Waters and Hydrological Behavior of a Small Granitic Basin (Vosges Massif, France): Annual and Daily Variations,
W86-03775 5B

AMPHLETT, M. B.
Measurement of Soil Loss from Experimental Basins in Malawi,
W86-03590 2J

ANNANDALE, G. W.
Predicting the Distribution of Depostied Sediment in Southern African Reservoirs,
W86-03605 2J

APPELO, C. A. J.
Hydrochemistry of Springs from Dolomite Reefs in the Southern Alps of Northern Italy,
W86-03765 2K

ARITOMI, N.
Specialized Dredges Designed for Bottom Sediment Dredging,
W86-03469 5G

ARMENTROUT, G. W.
Time of Travel and Dispersion of Solutes in a 36.4-Mile Reach of the North Platte River Downstream from Casper, Wyoming,
W86-03559 2E

ARMSTRONG, M. P.
Relationship Between Stream Recreational Use and Stream Characteristics with Implications for Management of Illinois Streams,
W86-03451 5G

ARTHUR, R. M.
Process Control Strategies,
W86-03729 5D

ARYA, L. M.
Comparison of Soil Moisture Characteristics Predicted by the Arya-Paris Model with Laboratory-Measured Data,
W86-03636 2G

ASADA, J.
Accumulation of Acrylamide into Fish,
W86-03878 5C

Studies on Analytical Method of Acrylamide Monomer and Accumulation into Fish,
W86-03466 5B

ATLAS, D.
Multi-Parameter Remote Measurement of Rainfall,
W86-03618 2B

AVANZINO, R. J.
Results of a Solute Transport Experiment at Uvas Creek, September 1972,
W86-03556 2E

AYIBOTELE, N. B.
Appraisal of Sediment Transport Measurement in Ghanaian Rivers,
W86-03586 7A

Some Critical Issues with Monitoring Crystalline Rock Aquifers for Groundwater Management in Rural Areas,
W86-03567 2F

BABA, Y.
Simulation of Estuarine Silt Transport According to Storm Water Runoff,
W86-03465 2J

BABCOCK, W. C.
Coupled Transport Membranes for Removal of Chromium from Electroplating Rinse Solutions,
W86-03534 5D

BABIY, I.
Reliability of Information in Hydrogeochemical Investigations,
W86-03769 7A

BACHMAT, Y.
Design of a Hydrochemical Data Collection Programme,
W86-03767 7A

BAILEY, P. A.
Distribution and Enrichment of Trace Metals (Cd, Cr, Cu, Ni, Pb, Zn) in Bottom Sediments of Navigation Pools 4 (Lake Pepin), 5 and 9 of the Upper Mississippi River,
W86-03742 5B

BAKER, J. S.
Hydrogeologic Data from a Test Well at Kathryn Abbey Hanna Park, City of Jacksonville, Florida,
W86-03555 2F

BAKER, R. W.
Coupled Transport Membranes for Removal of Chromium from Electroplating Rinse Solutions,
W86-03534 5D

BANCROFT, G. T.
Large-Scale Operations Management Test of Use of the White Amur for Control of Problem Aquatic Plants, Report 1: Baseline Studies, Volume V, The Herpetofauna of Lake Conway, Florida,
W86-03458 2H

BANNERMAN, R. R.
Some Critical Issues with Monitoring Crystalline Rock Aquifers for Groundwater Management in Rural Areas,
W86-03567 2F

BARNES, A. A.
Investigations of Large Scale Storm Systems: Final Report,
W86-03647 2B

BARNES, R. B.
Use of Landsat Digital Information for Assessing Glacier Inventory Parameters,
W86-03702 2C

BARNES, Z. K.
Comparison of Several Methods for Collection and Quantification of Polycyclic Aromatic Hydrocarbons from Aqueous Media,
W86-03812 5A

BARR, G. L.
Chemical Quality of Landfill Leachate in Treatment Ponds and Migration of Leachate in the Surficial Aquifer, Pinellas County, Florida,
W86-03549 5B

BARRETT, B.
Some Consequences of Wetland Modification to Louisiana's Fisheries,
W86-03858 2L

BARTH, E. F.
Implementation of Sequencing Batch Reactors for Municipal Wastewater Treatment,
W86-03664 5D

BASTIAN, D. F.
Verification of the Chesapeake Bay Model: Chesapeake Bay Hydraulic Model Investigation,
W86-03459 2L

BAUMANN, R. H.
Sedimentation and Apparent Sea-Level Rise as Factors Affecting Land Loss in Coastal Louisiana,
W86-03851 2J

BAUMGARTNER, D. J.
Stable Activable Tracers for Environmentally Significant Organic Molecules,
W86-03805 5A

BECHER, A. E.
Hydrology of Area 1, Eastern Coal Province, Pennsylvania,
W86-03547 2E

BEDIENT, P. B.
Modeling Chemical Reactions and Transport in Groundwater Systems: A Review,
W86-03428 5B

BEECH, J. A.
Pollution in Swimming Pool Water,
W86-03544 5B

BEEKMAN, H. E.
Hydrochemistry of Springs from Dolomite Reefs in the Southern Alps of Northern Italy,
W86-03765 2K

BENCALA, K. E.
Results of a Solute Transport Experiment at Uvas Creek, September 1972,
W86-03556 2E

BERGLIND, L.
Determination of Polycyclic Aromatic Hydrocarbons in Industrial Discharges and Other Aqueous Effluents,
W86-03506 5A

BERGMAN, H. L.
Complex Effluent Fate Modeling,
W86-03429 5B

BERNDT, C. L.
Textile Waste Treatment at a Municipal PACT Facility,
W86-03893 5D

BESSER, J. M.
Problems on the Upper Mississippi River and Its Tributaries: Need for a Long-Term Resource Monitoring Program,
W86-03751 7A

BETTESS, R.
Feasibility of Flushing Sediments through Reservoirs,
W86-03608 2J

BEWTRA, J. K.
Computation of Fractional Removal of Discrete and Flocculant Particles in Settling Basins,
W86-03667 5D

BICKNELL, B. R.
Application Guide for Hydrological Simulation Program: FORTRAN (HSPF),
W86-03614 2A

BIERMAN, V. J.
Phytoplankton-Nutrient Kinetics Mechanisms in Mathematical Simulation Models, with Special Attention to Reservoirs and Impoundments,
W86-03717 2H

BJORNSTAD, H.
Use of Different Physical Separation Techniques for Trace Element Speciation Studies in Natural Waters,
W86-03771 2K

BLACK, J. P.
Use of Granular Activated Carbon to Treat Municipal Wastewater Receiving Industrial Flow,
W86-03891 5D

BLACKMER, A. J.
Saline Groundwater Discharges from Crystalline Rocks Near Thunder Bay, Ontario, Canada,
W86-03786 2F

BLACKWELL, C. D.
Directory of Member Organizations of the National Water Data Exchange (NAWDEX),
W86-03557 10D

BLAKE, J.
Modelling Nitrate Pollution in Water Resource Systems: The Thames Nitrate Project,
W86-03657 5G

BLAKELY, R. J.
Present and Potential Use of Micro-Hydro-Electric Schemes in Remote Locations,
W86-03505 8A

BLOODWORTH, F. G.
Texas Manufacturing Water Use: Long-Term Projections,
W86-03441 6D

BOBLITT, G. T.
Final Environmental Impact Statement for Sludge Disposal for the Des Moines Integrated Community Area,
W86-03635 5E

BOER, H. A.
Geochemical Studies in the Drainage Basin of the Rio Vouga (Portugal). I. General Hydrogeochemistry from Its Origin to the Ria de Aveiro,
W86-03776 2K

BOLTON, P.
Sediment Deposition in Major Reservoirs in the Zambezi Basin,
W86-03606 2J

BOURN, R. D.
Oil Stop Valve: Oil Spill Containment Research and Development Project,
W86-03627 5G

BOUTEN, W.
Carbon Dioxide in the Soil Atmosphere: Simulation Model Parameter Estimation from Field Measurements,
W86-03755 2G

BOUZOUN, J. R.
Pilot-Scale Evaluation of the Nutrient Film Technique for Wastewater Treatment,
W86-03515 5D

BOWES, G. W.
Rice Herbicides: Molinate (Ordram) and Thiobencarb (Bolero),
W86-03447 5G

BOWMAN, J. W.
Corpus Christi Inner Harbor Water Quality Survey, August 1982,
W86-03440 5B

BOYD, R.
Assessment of Geological and Human Factors Responsible for Louisiana Coastal Barrier Erosion,
W86-03852 2J

BOYER, H. A.
Trace Elements in the Water, Sediments, and Fish of the Upper Mississippi River, Twin Cities Metropolitan Area,
W86-03745 5B

BRAITHWAITE, R. J.
Parameterization of Glacier Equilibrium Line Altitude,
W86-03696 2C

BRANDANI, A.
East-West and North-South Snow Line Gradients in the Northern Patagonian Andes, Argentina,
W86-03674 2C

BRANDON, C. A.
Hyperfiltration of Textile Process Water for Reuse,
W86-03535 5D

BRASSARD, C.
Onshore Impacts of Offshore Hydrocarbon Development: Annotated Bibliography,
W86-03620 5C

BRASWELL, J. W.
Final Environmental Impact Statement for Sludge Disposal for the Des Moines Integrated Community Area,
W86-03635 5E

BRILL, E. D.
Nonlinear Programming Model of a Wastewater Treatment System: Sensitivity Analysis and a Robustness Constraint,
W86-03511 5D

BRISSETTE, R. F.
Subsurface Investigation for Dredging Projects,
W86-03881 7A

BROCKMAN, C.
Glacier Inventory of Bolivia,
W86-03676 2C

BROOKS, M. H.
Inland Travel of Tide-Driven Saline Water in the Altamaha and Satilla Rivers, Georgia, and the St. Marys River, Georgia-Florida,
W86-03561 2L

BROWN, D. E.
Hydrology of Area 1, Eastern Coal Province, Pennsylvania,
W86-03547 2E

BROWN, D. P.
Hydrogeologic Data from a Test Well at Kathryn Abbey Hanna Park, City of Jacksonville, Florida,
W86-03555 2F

BROWN, G. J.
Anaerobic Pretreatment Facility Also Provides Sludge Disposal Capability and Source of Renewable Energy for Food Processor,
W86-03661 5D

BROWN, L. C.
Assessment of the Measurement Uncertainty in the Estimation of Stream Reaeration Rate Coefficients Using Direct Tracer Techniques,
W86-03824 5A

BRYCE, R. W.
Hydrochemical and Isotopic Content of Basalt Groundwaters Beneath the Hanford Site, Washington,
W86-03517 2K

BUCKLEY, D. K.
Character of Fractured Rock Aquifers in Eastern Botswana,
W86-03565 2F

BUHL, K. J.
Heavy Metal Accumulation in Selected Sessile Components of Fountain City Bay, Pool 5A, of the Upper Mississippi River,
W86-03744 5B

BURCHETT, C. R.
Ground Water in Carbonate Rocks and Regolith in the Fairview Area, Tennessee,
W86-03548 2F

BURLESON, J. L.
Analysis of Chlorinated Organic Compounds Formed During Chlorination of Wastewater Products,
W86-03496 5A

Further Optimization of the Pentane Liquid-Liquid Extraction Method for the Analysis of Trace Organic Compounds in Water,
W86-03808 5A

BURNHAM, J. C.
Utilization of Bacteria in Managing Cyanobacterial Populations: A Review and Update,
W86-03493 2H

BURNS, L. A.
Identification and Evaluation of Fundamental Transport and Transformation Process Models,
W86-03422 5B

BURSEY, J. T.
Quantitative Aspects of the Master Analytical Scheme for Organics in Water,
W86-03796 5A

BUSCH, A. W.
Compatibility Assessment of Municipal/Industrial Wastewaters for Combined Biological Treatment,
W86-03887 5D

BUSSOM, D. E.
Use of Landsat Digital Information for Assessing Glacier Inventory Parameters,
W86-03702 2C

BUTCH, G. K.
Floods of March 1982, Indiana, Michigan, and Ohio,
W86-03552 2E

BUTLER, P. L.
Pilot-Scale Evaluation of the Nutrient Film Technique for Wastewater Treatment,
W86-03515 5D

CALDWELL, J.
Surface Erosion and Sediment Control at Open-Cast Mines in Southern Africa,
W86-03602 4D

CARLSON, R. E.
Detection and Quantification of Electrophiles in Environmental Samples: Labeling of Potential Mutagens in Drinking Water by 4-Nitrothiophenol,
W86-03820 5A

CARR, D. J.
Characteristics and Treatability of Urban Runoff Residuals,
W86-03508 5B

CARTWRIGHT, K. J.
Fate and Transport Modeling for Toxic Substances,
W86-03425 5B

CASE , H. L.
Geologic and Hydrologic Data from a Test-Drilling Program in the High Plains Areas of South Dakota, 1979-1980,
W86-03558 2F

CATON, J. E.
Comparison of Several Methods for Collection and Quantification of Polycyclic Aromatic Hydrocarbons from Aqueous Media,
W86-03812 5A

CAULFIELD, H. P.
Viability of Interbasin, Interstate/International Transfers of Water,
W86-03436 6D

CAVACAS, A.
Hydrologic Modeling for Studies of Pollutant Loadings and Transport in Large River Basins,
W86-03827 5A

CHABRECK, R. H.
Effect of Coastal Alteration on Marsh Plants,
W86-03856 2L

CHAMBERS, A. M.
Verification of the Chesapeake Bay Model: Chesapeake Bay Hydraulic Model Investigation,
W86-03459 2L

CHATTERS, J. C.
Human Adaptation Along the Columbia River 4700-1600 BP.: A Report of Test Excavation at River Mile 590, North Central Washington,
W86-03460 6E

CHEBOSI, P. K.
Estimating Groundwater Recharge Based on Infiltration Characteristics of Layered Soil,
W86-03566 2F

CHEH, A. M.
Detection and Quantification of Electrophiles in Environmental Samples: Labeling of Potential Mutagens in Drinking Water by 4-Nitrothiophenol,
W86-03820 5A

CHEN, Y. H.
Investigation of Effects of Navigation Traffic Activities on Hydrologic, Hydraulic, and Geomorphic Characteristics in the Upper Mississippi River System,
W86-03750 5B

CHENG , P-H.
Distribution, Features and Variations of Glaciers in China,
W86-03684 2C

Recent Research on Glaciers on the Chinhai-Tibet Plateau,
W86-03685 2C

CHILDS, S. W.
Instrumentation and Methods Evaluations for Shallow Land Burial of Waste Materials: Water Erosion,
W86-03510 5E

CHILTON, P. J.
Characteristics of the Weathered Basement Aquifer in Malawi in Relation to Rural Water Supplies,
W86-03568 2F

Performance of Sanitary Completion Measures of Wells and Boreholes Used for Rural Water Supplies in Malawi,
W86-03582 5G

CHINN, T. J.
Glacier Balances in the Dry Valleys Area, Victoria Land, Antarctica,
W86-03694 2C

Glacier Snow Line Variations in the Southern Alps, New Zealand,
W86-03692 2C

CHIORSE, W. C.
Insoluble Polymeric Contact Disinfectants: An Alternative Approach to Water Disinfection,
W86-03543 5F

CHRISTENSEN, R. G.
Developments in the Analysis of Priority Pollutants by Liquid Chromatography/Mass Spectrometry and Immunoassay Procedures,
W86-03819 5A

CLAFLIN, T. O.
Ecological History of the Upper Mississippi River,
W86-03738 6G

CLEAVE, M. L.
Use of Bioassay Approaches for Assessing Phytoplankton Growth in Lakes and Reservoirs,
W86-03723 5C

CLEVELAND, G. C.
Human Adaptation Along the Columbia River 4700-1600 BP.: A Report of Test Excavation at River Mile 590, North Central Washington,
W86-03460 6E

COCCI, A. A.
Anaerobic Pretreatment Facility Also Provides Sludge Disposal Capability and Source of Renewable Energy for Food Processor,
W86-03661 5D

COCH, C. A.
Alternatives to Open Water Disposal of Contaminated Dredged Material,
W86-03879 5E

COHEN, D. B.
Rice Herbicides: Molinate (Ordram) and Thiobencarb (Bolero),
W86-03447 5G

COHEN, I. D.
Investigations of Large Scale Storm Systems: Final Report,
W86-03647 2B

COLBY, B. N.
Determination of Priority Pollutants in Industrial Wastewaters by Stable-Isotope Dilution Gas Chromatography/Mass Spectrometry,
W86-03804 5A

COLE, B. P.
Longitudinal Distribution of Trace Elements (As, Cd, Cr, Hg, Pb, and Se) in Fishes and Sediments in the Upper Mississippi River,
W86-03743 5B

COLLINET, J.
Evaluation of Factors Influencing Water Erosion in West Africa Using Rainfall Simulation,
W86-03598 2J

COLLINS, C. D.
Modeling Combined Effects of Environmental Factors on Phytoplankton,
W86-03718 2H

COLLINS, E. V.
Aquaculture Thesaurus: Descriptors Used in the National Aquaculture Information System,
W86-03643 10C

COLLINS, S. G.
Use of Landsat Digital Information for Assessing Glacier Inventory Parameters,
W86-03702 2C

CONN, L. G.
Drought-Related Impacts on Municipal and Major Self-Supplied Industrial Water Withdrawals in Tennessee, (Part A and Part B),
W86-03560 6D

CONROD, M. G.
Coupled Transport Membranes for Removal of Chromium from Electroplating Rinse Solutions,
W86-03534 5D

CONROY, L. E.
Determination of Carbohydrates and Primary Amines in River Water,
W86-03524 5A

Ultraviolet Multiwavelength Absorbance Measurements for Monitoring Trace Organics in Water,
W86-03525 5A

COOK, C. J.
Modeling Chemical Reactions and Transport in Groundwater Systems: A Review,
W86-03428 5B

COOK, J. M.
Comparative Study of Sequential Redox Processes in Three British Aquifers,
W86-03758 2F

COOKE, G. D.
State-of-the-Art Summary of Phosphorus Inactivation as a Lake Restoration Technique,
W86-03486 5G

COOPER, C. M.
Recent Rates of Sedimentation in the Mississippi River,
W86-03741 2J

COOPER, W. E.
Assessment of Transport and Fate of Toxic Materials in an Experimental Stream Ecosystem,
W86-03433 5B

COOPER, W. J.
Development of a TOC/COD Analyzer for Process Applications,
W86-03526 5A

CORNACCHIA, J. W.
Rice Herbicides: Molinate (Ordram) and Thiobencarb (Bolero),
W86-03447 5G

CORTE, A. E.
Glaciers and Glaciolithic Systems of the Central Andes,
W86-03675 2C

COSTANZA, R.
Canals and Wetland Erosion Rates in Coastal Louisiana,
W86-03855 6G

COSTELLO, M.
Insoluble Polymeric Contact Disinfectants: An Alternative Approach to Water Disinfection,
W86-03543 5F

COX, R. D.
Master Analytical Scheme: Development of Effective Techniques for Isolation and Concentration of Organics in Water,
W86-03794 5A

CRADDOCK, J. M.
Water Pollution: Industry and Government Working Together - A Case Study of Muncie, Indiana's Industrial Pretreatment Program,
W86-03898 5A

CRAIG, J. S.
Master Analytical Scheme: An Overview of Interim Procedures,
W86-03793 5A

CRAIG, N. J.
Comparison of Effectiveness of Management Options for Wetland Loss in the Coastal Zone of Louisiana,
W86-03866 2L

CRAMER, P.
Development of Methods for Pesticides in Wastewater: Applicability of a General Approach,
W86-03798 5A

CRANE, R.I.
Development of Techniques for the Isolation and Identification of Nonvolatile Organics in Drinking Water,
W86-03816 5A

CRATHORNE, B.
Development of Techniques for the Isolation and Identification of Nonvolatile Organics in Drinking Water,
W86-03816 5A

CRAWFORD, N. H.
Hydrologic Transport Modeling,
W86-03427 5B

CREASEY, J.
Conditions and Frequency of Sampling for Elucidations of Transport Mechanisms and Element Budgets in Upland Drainage Basins,
W86-03770 7A

CRESSER, M. S.
Conditions and Frequency of Sampling for Elucidations of Transport Mechanisms and Element Budgets in Upland Drainage Basins,
W86-03770 7A

CRISMAN, T. L.
Algal Control through Trophic-Level Interactions: A Subtropical Persepctive,
W86-03490 5G

CRITES, R. W.
Land Treatment of Combined Municipal/Industrial Wastewaters,
W86-03896 5D

CROSBY, L. G.
Verification of the Chesapeake Bay Model: Chesapeake Bay Hydraulic Model Investigation,
W86-03459 2L

CROSSMAN, J. S.
Phytoplankton Effects of Reservoir Use,
W86-03722 5G

CRUICKSHANK, M. J.
Anti-Turbidity Overflow System (ATOS) Used for Reducing the Dispersion of Fine Sediments from a Dredge Plane,
W86-03874 5E

CUMMINGS, T. R.
Hydrology and Land Use in Van Buren County, Michigan,
W86-03554 2E

DAILEY, L. L.
Determination of Chlorine Dioxide,
W86-03541 5A

DAMHAUG, T.
Alkalinity Feed Forward Control of Alum Addition in Wastewater Treatment,
W86-03666 5D

DARVIN, C.
Demonstration of a Cross-Flow Microfiltration System from the Removal of Toxic Heavy Metals from Battery Manufacturing Wastewater Effluents,
W86-03533 5D

DAVENPORT, R. J.
Development of a TOC/COD Analyzer for Process Applications,
W86-03526 5A

DAVENPORT, T. E.
Water Resource Data and Trend Analysis for the Blue Creek Watershed Project, Pike County, Illinois: Phase II,
W86-03610 5G

DAVIDSON, S. A.
Comparison of Soil Moisture Characteristics Predicted by the Arya-Paris Model with Laboratory-Measured Data,
W86-03636 2G

DAVIS, D. W.
Economic and Cultural Consequences of Land Loss in Louisiana,
W86-03861 6G

DAVIS, R. A.
Computerization: Can It Work for You,
W86-03731 5D

DAVIS, R. E.
Geochemistry and Geohydrology of the West Decker and Big Sky Coal-Mining Areas, Southeastern Montana,
W86-03545 2K

DAWSON, V. K.
Water Chemistry at Selected Sites on Pools 7 and 8 of the Upper Mississippi River: A Ten-Year Survey,
W86-03749 5B

DAY, J. W.
Comparison of Effectiveness of Management Options for Wetland Loss in the Coastal Zone of Louisiana,
W86-03866 2L

DAYER, G.
Discharge Forecasting from Glacierized Areas to Optimize Hydroelectric Power Management,
W86-03848 8C

DE HAEN, H.
Impact of Nitrogen Fertilizer Application on the Nitrate Concentration in Groundwater: Cost-Benefit Analysis Considerations,
W86-03652 5G

DE VRE, F. M.
Carbon Dioxide in the Soil Atmosphere: Simulation Model Parameter Estimation from Field Measurements,
W86-03755 2G

DEAN, J. M.
Mariculture in Old Rice Field Impoundments: An Analogy for Dredged Material Containment Areas,
W86-03711 2L

DEAN, R. B.
Use of Log-Normal Statistics in Environmental Monitoring,
W86-03531 7C

DEB, A. K.
Desk Top Methodology for Nonpoint Source Load Evaluation,
W86-03836 5B

DEBYLE, N. V.
Streamflow Summaries from Twelve Tributaries of Farmington Creek, Davis County Experimental Watershed, Northern Utah,
W86-03640 2A

DEGARIE, C. J.
Anaerobic Pretreatment Facility Also Provides Sludge Disposal Capability and Source of Renewable Energy for Food Processor,
W86-03661 5D

DEJOHN, P. B.
Use of Granular Activated Carbon to Treat Municipal Wastewater Receiving Industrial Flow,
W86-03891 5D

DELAUNE, R. D.
Sedimentation and Apparent Sea-Level Rise as Factors Affecting Land Loss in Coastal Louisiana,
W86-03851 2J

DELOS, C.
Predictive Fate Models: Their Role in the U.S. Environmental Protection Agency's Water Program,
W86-03421 5B

DENNIS, W. H.
Biological Evaluation of Methods for the Determination of Free Available Chlorine,
W86-03539 5A

DENTON, R. A.
Currents in San Pablo Bay,
W86-03449 2L

Currents in Suisun Bay,
W86-03448 2L

DESJARDINS, P. R.
Cyanophages: Are They Potential Biological Control Agents of Nuisance Blue-Green Algae,
W86-03492 2H

DI TORO, D. M.
Simplified Model of the Fate of Partitioning Chemicals in Lakes and Streams,
W86-03426 5B

DIAS, J. R.
Priority Pollutant Methodology Quality Assurance Review,
W86-03529 5A

DIENER, C. J.
Pilot-Scale Evaluation of the Nutrient Film Technique for Wastewater Treatment,
W86-03515 5D

DONIGAN, A. S.
Application Guide for Hydrological Simulation Program: FORTRAN (HSPF),
W86-03614 2A

DONIGIAN, A. S.
Field Validation and Error Analysis of Chemical Fate Models,
W86-03431 5B

Groundwater Contamination and Emergency Response Guide,
W86-03457 5G

DREYER, N. N.
Use of the Data of Glacier Inventories for Compilation of the World Atlas of Snow and Ice Resources,
W86-03701 2C

DRINKWINE, A.
Development of Methods for Pesticides in Wastewater: Applicability of a General Approach,
W86-03798 5A

DROMGOOLE, E. L.
Report of Analyses for Light Hydrocarbons in Ground Water,
W86-03512 5A

DU PLESSIS, A. J. R.
Treatment of Combined Industrial and Domestic Wastewater for Reuse in South Africa,
W86-03890 5D

DUDEK, D. J.
Integrated Physical-Economic Systems Analysis of Irrigated Agriculture,
W86-03658 5G

DUFFIN, G. I.
Ground-Water Conditions of the Triassic Aquifer in Deaf Smith and Swisher Counties,
W86-03439 2F

DUNFORD, W. G.
Solar Powered Groundwater Pumping for Medium Heads,
W86-03583 8C

DUYSINGS, J. J. H.
Carbon Dioxide in the Soil Atmosphere: Simulation Model Parameter Estimation from Field Measurements,
W86-03755 2G

EBISE, S.
Separation of Runoff Components by NO3-N Loading and Estimation of Runoff Loading by Each Component,
W86-03788 5B

EDDS, J.
Ground-Water Levels in Arkansas, Spring 1984,
W86-03553 2F

EDMUNDS, W. M.
Comparative Study of Sequential Redox Processes in Three British Aquifers,
W86-03758 2F

EDWARDS, A. C.
Conditions and Frequency of Sampling for Elucidations of Transport Mechanisms and Element Budgets in Upland Drainage Basins,
W86-03770 7A

EDWARDS, R. W.
Use of Granular Activated Carbon to Treat Municipal Wastewater Receiving Industrial Flow,
W86-03891 5D

EGBOKA, B. C. E.
Gully Erosion in the Agulu-Nanka Region of Anambra State, Nigeria,
W86-03589 2J

ELDERHORST, W. L M.
Role of Modeling in the Development of African Groundwater Resources,
W86-03578 2F

ELLINGTON, J. J.
Master Analytical Scheme: An Overview of Interim Procedures,
W86-03793 5A

ELLIS, S. S.
Investigation of Effects of Navigation Traffic Activities on Hydrologic, Hydraulic, and Geomorphic Characteristics in the Upper Mississippi River System,
W86-03750 5B

ELWELL, H. A.
Sheet Erosion from Arable Lands in Zimbabwe: Prediction and Control,
W86-03596 2J

ERICKSON, P. R.
Mechanical Dewatering of Dredged Slurries,
W86-03872 5D

ERIKSSON, E.
Hydrochemical Processes in Groundwater Discharge Areas,
W86-03762 2F

ESTES, E. R.
Chimney Hill Off-Site Drainage Study,
W86-03835 2A

ETTEL, G. E.
Understanding the Application of Analytical Data to Process Control,
W86-03730 5D

EWEL, K. C.
Large-Scale Operations Management Test of Use of the White Amur for Control of Problem Aquatic Plants, Report 2: First Year Poststocking Results,
W86-03454 2H

FABER, R. A.
Polychlorinated Biphenyls and Organochlorine Insecticides in Great Blue Heron and Great Egret Eggs from the Upper Mississippi River,
W86-03747 5B

FAGO, D.
Distribution and Relative Abundance of Fishes in Wisconsin; V: Grant and Platte, Coon and Bad Axe, and LaCrosse River Basins,
W86-03501 6G

FAIRLESS, B. J.
Priority Pollutant Methodology Quality Assurance Review,
W86-03529 5A

FARRELL, M. P.
Evaluating Changes in Dike Field Fishes with Community Information Indices,
W86-03628 7A

Evaluation of Community Information Indices for Mississippi River Fisheries,
W86-03499 7C

FENN, D. D.
Probable Maximum Precipitation Estimates for the Drainage Above Dewey Dam, Johns Creek, Kentucky,
W86-03503 2B

FERNANDEZ, A.
Glacier Inventory of Bolivia,
W86-03676 2C

FERNANDEZ, M.
Chemical Quality of Landfill Leachate in Treatment Ponds and Migration of Leachate in the Surficial Aquifer, Pinellas County, Florida,
W86-03549 5B

Evaluation of Future Base-Flow Water-Quality Conditions in the Hillsborough River, Florida,
W86-03546 5B

FERRIGNO, J. G.
Satellite Image Atlas of Glaciers,
W86-03703 2C

FIELDING, M.
Development of Techniques for the Isolation and Identification of Nonvolatile Organics in Drinking Water,
W86-03816 5A

FILKINS, J. C.
Analysis of Polychlorinated Biphenyls by Glass Capillary and Packed-Column Chromatography,
W86-03802 5A

FIORONI, E. R.
Polysar Biological Oxidation Treatment Plant,
W86-03660 5D

FIORONI, R.
Good Process Control: Planning and Implementation,
W86-03735 5D

FITZGERALD, G. P.
Selective Algicides,
W86-03485 5G

FONTAINE, T. D.
Large-Scale Operations Management Test of Use of the White Amur for Control of Problem Aquatic Plants, Report 2: First Year Poststocking Results,
W86-03454 2H

FOSTER, S. S. D.
African Groundwater Development-The Challenges for Hydrogeological Science,
W86-03563 2F

FRAIS, W. D.
Good Process Control: Planning and Implementation,
W86-03735 5D

FRALISH, S. H.
Final Environmental Impact Statement for Sludge Disposal for the Des Moines Integrated Community Area,
W86-03635 5E

FRAPE, S. K.
Saline Groundwater Discharges from Crystalline Rocks Near Thunder Bay, Ontario, Canada,
W86-03786 2F

FREEL, M. W.
Preliminary Guide to the Onsite Identification and Delineation of the Wetlands of the South Atlantic United States,
W86-03480 2H

FREEMAN, R. R.
Chromatographic Considerations for the Analysis of Acid-Extractable Priority Pollutants,
W86-03800 5A

FREMLING, C. R.
Ecological History of the Upper Mississippi River,
W86-03738 6G

FRIDAY, J.
Statistical Summaries of Streamflow Data in Oregon; Volume 1 Eastern Oregon,
W86-03550 2E

FRIEDMAN, J. A.
Hydrologic Modeling for Studies of Pollutant Loadings and Transport in Large River Basins,
W86-03827 5A

FRINK, C. R.
Chemical and Physical Properties of Connecticut Lakes,
W86-03438 2H

FRITZ, B.
Physico-Chemical Characteristics of Surface Waters and Hydrological Behavior of a Small Granitic Basin (Vosges Massif, France): Annual and Daily Variations,
W86-03775 5B

Respiratory Gas Content (O2 and CO2) and Ionic Composition of River Water in the Plain of Alsace (Eastern France),
W86-03763 2F

FRITZ, J. S.
Thermal Desorption from a XAD-4 Adsorption Substrate for Water Analysis by Capillary Gas Chromatography,
W86-03811 5A

FRITZ, P.
Saline Groundwater Discharges from Crystalline Rocks Near Thunder Bay, Ontario, Canada,
W86-03786 2F

FROST, F.
Giardiasis in Washington State,
W86-03507 5C

FRUGE, D. W.
Effects of Wetland Deterioration on the Fish and Wildlife Resources of Coastal Louisiana,
W86-03857 2L

FRUMAN, D.
Demonstration of a Cross-Flow Microfiltration System from the Removal of Toxic Heavy Metals from Battery Manufacturing Wastewater Effluents,
W86-03533 5D

FUJIKI, M.
Accumulation of Acrylamide into Fish,
W86-03878 5C

Studies on Analytical Method of Acrylamide Monomer and Accumulation into Fish,
W86-03466 5B

FUKUSHIMA, T.
Restoration Study of Dredging in Lake Ksaumigaura,
W86-03468 5G

FUKUTAKI, K.
Giardiasis in Washington State,
W86-03507 5C

FUSHIMI, H.
Glacier Inventory in the Dudh Kosi Region, East Nepal,
W86-03682 2C

GABRIELS, D.
Testing the Applicability of a Soil Erodibility Nomogram for Some Tropical Soils,
W86-03599 2J

GAMBRELL, R. P.
Literature Survey of Reservoir Contaminant Problems,
W86-03623 5B

GAMES, L. M.
Field Validation of Exposure Analysis Modeling System (EXAMS) in a Flowing Stream,
W86-03432 5B

GARRISON, A. W.
Evaluation of Trace Enrichment Methodology in Conjuction with Reverse-Phase High-Performance Liquid Chromatography for Preconcentration, Separation and Quantification of Trace Non-Volatile Organic Compounds in Aqueous Environmental Samples,
W86-03817 5A

Master Analytical Scheme: An Overview of Interim Procedures,
W86-03793 5A

GATHURU, N.
Water Resources Assessment Study in Kiambu District, Kenya,
W86-03571 2F

GAUDY, A. F.
Functional Design of Activated Sludge Processes,
W86-03670 5D

Treatment of Municipal Wastewaters Containing Biologically Hazardous Industrial Compounds by Conventional Activated Sludge and Extended Aeration,
W86-03889 5D

GAVIN, J.
Recent Secular Variations of Snow and Sea Ice Cover,
W86-03695 2C

GEBHART, J. E.
Master Analytical Scheme: An Assessment of Factors Influencing Precision and Accuracy of Gas Chromatography/Mass Spectrometry Data,
W86-03795 5A

Master Analytical Scheme: Development of Effective Techniques for Isolation and Concentration of Organics in Water,
W86-03794 5A

GEHR, R.
Dissolved Air Flotation for Primary and Secondary Clarification,
W86-03611 5D

GEINOPOLOS, A.
Characteristics and Treatability of Urban Runoff Residuals,
W86-03508 5B

GEIRNAERT, W.
Isotope Studies as a Final Stage in Groundwater Investigations on the African Shield,
W86-03574 2F

GERBA, C. P.
Insoluble Polymeric Contact Disinfectants: An Alternative Approach to Water Disinfection,
W86-03543 5F

GHANNAM, L. M.
Stable Activable Tracers for Environmentally Significant Organic Molecules,
W86-03805 5A

GHIRELLI, R. P.
Polychlorinated Biphenyls (PCBs),
W86-03446 5G

GHUMAN, B. S.
Testing the Applicability of a Soil Erodibility Nomogram for Some Tropical Soils,
W86-03599 2J

GIBBONS, G. M.
Final Environmental Impact Statement for Sludge Disposal for the Des Moines Integrated Community Area,
W86-03635 5E

GIESY, J. P.
Anomalous Breakthrough of Benzo(A)Pyrene during Concentration with Amberlite XAD-4 Resin from Aqueous Solutions,
W86-03813 5A

GIETZ, R. J.
Stormwater Runoff Treatment by Impoundment: Barrhaven Pilot Study,
W86-03632 5D

GIGER, W.
Determination of Phenolic Water Pollutants by Glass Capillary Gas Chromatography,
W86-03799 5A

GINNA, T. C.
Aeration/Circulation for Control of Algal Production,
W86-03487 2G

GIORDANO, A.
Some Methods for Evaluating Soil Erosion Risk,
W86-03593 2J

GIRARD, P. W.
Comparison of Stirred Suspension and Fixed Film Anaerobic Digestion Systems,
W86-03668 5D

GLATFELTER, D. R.
Floods of March 1982, Indiana, Michigan, and Ohio,
W86-03552 2E

GLAZE, W. H.
Analysis of Chlorinated Organic Compounds Formed During Chlorination of Wastewater Products,
W86-03496 5A

Further Optimization of the Pentane Liquid-Liquid Extraction Method for the Analysis of Trace Organic Compounds in Water,
W86-03808 5A

Size Exclusion, Reverse-Phase and Weak Anion Exchange Chromatography of National Organics in Water,
W86-03815 5A

GODLEY, J. S.
Large-Scale Operations Management Test of Use of the White Amur for Control of Problem Aquatic Plants, Report 1: Baseline Studies, Volume V, The Herpetofauna of Lake Conway, Florida,
W86-03458 2H

GOETZ, C. L.
Evaluation of Future Base-Flow Water-Quality Conditions in the Hillsborough River, Florida,
W86-03546 5B

GOODMAN, G.
Hyperfiltration of Textile Process Water for Reuse,
W86-03535 5D

GOSSELINK, J. G.
Wetland Loss Directly Associated with Canal Dredging in the Louisiana Coastal Zone,
W86-03854 6G

GOTTSCHALK, L.
Data Collection for Hydrochemical Balances: Theoretical Aspects,
W86-03766 2A

GRAHAM, D. L.
Hydrochemical and Isotopic Content of Basalt Groundwaters Beneath the Hanford Site, Washington,
W86-03517 2K

GRAHAM, J. A.
Evaluation of Trace Enrichment Methodology in Conjuction with Reverse-Phase High-Performance Liquid Chromatography for Preconcentration, Separation and Quantification of Trace Non-Volatile Organic Compounds in Aqueous Environmental Samples,
W86-03817 5A

GRANAT, M. A.
Verification of the Chesapeake Bay Model: Chesapeake Bay Hydraulic Model Investigation,
W86-03459 2L

GRAUVENGEL, L. W.
Final Environmental Impact Statement for Sludge Disposal for the Des Moines Integrated Community Area,
W86-03635 5E

GRIEST, W. H.
Comparison of Several Methods for Collection and Quantification of Polycyclic Aromatic Hydrocarbons from Aqueous Media,
W86-03812 5A

GROEN, M.
Isotope Studies as a Final Stage in Groundwater Investigations on the African Shield,
W86-03574 2F

GUSTAFSSON, E.
Studies on Groundwater Transport in Fractured Crystalline Rock under Controlled Conditions Using Nonradioactive Tracers,
W86-03497 2F

GUSWA, J. H.
Groundwater Contamination and Emergency Response Guide,
W86-03457 5G

HAAS, C. N.
Rational Approaches in the Analysis of Chemical Disinfection Kinetics,
W86-03538 5D

HAEBERER, A. F.
High-Performance Liquid Chromatographic Analysis of Nitrophenols,
W86-03814 5A

High-Performance Liquid Chromatographic Determination of Nitrosamines in Water and Wastewater,
W86-03818 5A

Master Analytical Scheme: An Overview of Interim Procedures,
W86-03793 5A

HAMAGUCHI, S.
Rehabilitation of Estuaries in Tsu-Matsusaka Harbor,
W86-03880 5G

HANDA, B. K.
Temporal Changes in Ground Water Quality in the Phreatic Zone Uttar Pradesh (India) and Their Impact on Sampling Schedule,
W86-03768 2F

Water Quality and Water Pollution Problems on the Indian Sub-Continent,
W86-03781 5B

HARO, H.
Hydrometeorological Data Acquisition: Innovative, High-Resolution Programmable Instrumentation for Stormwater Management,
W86-03829 7B

HARRISON, R.
Legal Environment of a Containment Site: Laws Governing the Acquisition, Maintenance, and Operation of Dredged Material Disposal Sites,
W86-03715 6E

HART, J.
Fate of Oil and Dispersant Mixtures in Freshwater,
W86-03637 5B

HARTER, L.
Giardiasis in Washington State,
W86-03507 5C

HARTIGAN, J. P.
Hydrologic Modeling for Studies of Pollutant Loadings and Transport in Large River Basins,
W86-03827 5A

Use of Continuous Simulation Model Calibration Techniques to Develop Nonpoint Pollution Loading Factors,
W86-03828 5B

HASSETT, A. J.
Control and Measurement of Organic Micropollutants in South African Water Reclamation Plants,
W86-03522 5A

HEEDERIK, J. P.
Water Resources Assessment Study in Kiambu District, Kenya,
W86-03571 2F

HENDERSON, J. E.
Analysis of Chlorinated Organic Compounds Formed During Chlorination of Wastewater Products,
W86-03496 5A

HENRY, D.
Hydrometeorological Data Acquisition: Innovative, High-Resolution Programmable Instrumentation for Stormwater Management,
W86-03829 7B

HENRY, J. G.
Dissolved Air Flotation for Primary and Secondary Clarification,
W86-03611 5D

HERB, W. J.
Hydrology of Area 1, Eastern Coal Province, Pennsylvania,
W86-03547 2E

HERN, D. C.
Geologic and Hydrologic Data from a Test-Drilling Program in the High Plains Areas of South Dakota, 1979-1980,
W86-03558 2F

HERN, S. C.
Effect of Light Attenuation on the Relationship of Phytoplankton Biomass to Phosphorus Levels,
W86-03726 2H

Relationship of Common Dominant Phytoplankton to Water Temperature and Season,
W86-03724 2H

Relationship of Common Phytoplankton Genera to Nutrients in Eastern and Southeastern Lakes,
W86-03725 2H

HERTZ, H. S.
Developments in the Analysis of Priority Pollutants by Liquid Chromatography/Mass Spectrometry and Immunoassay Procedures,
W86-03819 5A

HETZEL, D. R.
Relationship of Common Dominant Phytoplankton to Water Temperature and Season,
W86-03724 2H

HEURICH, E-M.
Insoluble Polymeric Contact Disinfectants: An Alternative Approach to Water Disinfection,
W86-03543 5F

HIGHFILL, R. E.
Design Criteria for Aquaculture Ponds on Dredged Material,
W86-03713 8I

HIGUCHI, K.
Glacier Inventory in the Dudh Kosi Region, East Nepal,
W86-03682 2C

HIXSON, S. W.
Phytoplankton Effects of Reservoir Use,
W86-03722 5G

HOANG, D.
Dynamic Model Adjustment,
W86-03831 2A

HOFFMAN, E. L.
Induced Change and Its Impact on Aquatic Community Quality in the Sangamon River Basin of Illinois,
W86-03453 5G

Planning Approach for Improved Management of Illinois Streams for Recreation and Conservation,
W86-03452 5G

HOLLERMAN, W. D.
Pond Management: Water Quality Criteria and Control,
W86-03708 5G

HOLLINGER, M. B.
Aquaculture Thesaurus: Descriptors Used in the National Aquaculture Information System,
W86-03643 10C

HOLLYDAY, E. F.
Ground Water in Carbonate Rocks and Regolith in the Fairview Area, Tennessee,
W86-03548 2F

HOLMAN, B.
Giardiasis in Washington State,
W86-03507 5C

HOLMAN, L.
1981 CCOPE PROBE Mesonet Calibration and Maintenance Procedures,
W86-03481 7B

HOLTSCHLAG, D. J.
Hydrology and Land Use in Van Buren County, Michigan,
W86-03554 2E

HOPKE, P. K.
Effect of Soil on the Mutagenic Properties of Waste Water,
W86-03502 5C

HOPSTAKEN, C. F. A.
Geochemical Studies in the Drainage Basin of the Rio Vouga (Portugal). I. General Hydrogeochemistry from Its Origin to the Ria de Aveiro,
W86-03776 2K

HORA, M. E.
Polychlorinated Biphenyls (PCBs) in Common Carp (Cyprinus carpio) of the Upper Mississippi River,
W86-03746 5B

HORIE, T.
Aeration Effects on Marine Eutrophication,
W86-03868 5G

HORNER, G. L.
Integrated Physical-Economic Systems Analysis of Irrigated Agriculture,
W86-03658 5G

HORNER, R. R.
Predictive Model for Highway Runoff Pollutant Concentrations and Loadings,
W86-03834 2A

HOSOMI, M.
Comparison of Methods for Estimating Nutrient Release from Lake Sediments,
W86-03477 5B

HOSTETLER, D. D.
Instrumentation and Methods Evaluations for Shallow Land Burial of Waste Materials: Water Erosion,
W86-03510 5E

HOVIS, J. S.
Assessment of the Measurement Uncertainty in the Estimation of Stream Reaeration Rate Coefficients Using Direct Tracer Techniques,
W86-03824 5A

Study of the Selection, Calibration and Verification of Mathematical Water Quality Models,
W86-03823 5B

HRIBERNICK, P.
Legal Implications of Coastal Erosion in Louisiana,
W86-03860 6E

HSIEH, T-C.
Distribution, Features and Variations of Glaciers in China,
W86-03684 2C

HUDGINS, R. R.
Waterloo Clarifier: Principles and Practice,
W86-03663 5D

HUDSON, R. E.
Overview of a Dredging Demonstration in Contaminated Material, James River, Virginia,
W86-03474 5G

HUFFMAN, R. T.
Preliminary Guide to the Onsite Identification and Delineation of the Wetlands of the South Atlantic United States,
W86-03480 2H

HUGHES, D. A.
Continuous Monitoring of Rainfall, Streamflow and Suspended Sediment Concentration in Semi-arid Environments,
W86-03591 7B

HUGHTO, R. J.
Calibration of Hydrology and Sediment Transport on Small Agricultural Watersheds Using HSPF,
W86-03825 2J

HUNT, B.
Mathematical Analysis of Groundwater Resources,
W86-03478 2F

HURST, J.
Mechanical Dewatering of Dredged Slurries,
W86-03872 5D

IDELOVITCH, E.
Gross Organics Measurements for Monitoring of Wastewater Treatment and Reuse,
W86-03523 5A

ILHAN, F.
Relating BOD5 with On-Line Oxygen Uptake Rate Measurements Using Automatic Respirometers in View of Process Monitoring and Control,
W86-03733 5D

IMHOFF, J. C.
Application Guide for Hydrological Simulation Program: FORTRAN (HSPF),
W86-03614 2A

IRIE, Y.
Field Dredging Test of Soft Mud Layer by a Front-Open Type Drag Head,
W86-03473 5G

ISHIMATSU, N.
New Techniques Developed in Japan for Oil Spill Cleanup,
W86-03875 5B

ISSAR, A. S.
Hydrochemical Relationships Between Rainwater, Floods, Groundwater and Lithology in the Avedat Group on the Negev Highlands, Israel,
W86-03789 2A

IWATA, S.
Glacier Inventory in the Dudh Kosi Region, East Nepal,
W86-03682 2C

JACENKOW, O. B.
Artificial Recharge of Groundwater Resources in Semiarid Regions,
W86-03572 4B

JACKSON, G. A.
Longitudinal Distribution of Trace Elements (As, Cd, Cr, Hg, Pb, and Se) in Fishes and Sediments in the Upper Mississippi River,
W86-03743 5B

Problems on the Upper Mississippi River and Its Tributaries: Need for a Long-Term Resource Monitoring Program,
W86-03751 7A

Water Chemistry at Selected Sites on Pools 7 and 8 of the Upper Mississippi River: A Ten-Year Survey,
W86-03749 5B

JACOBSEN, K.
Glacier Inventory of Bolivia,
W86-03676 2C

JAMES, W.
Atmospheric Pollution in Relation to Storm Water Quality Modelling: Literature Review for an Industrial City,
W86-03838 5B

Hydrometeorological Data Acquisition: Innovative, High-Resolution Programmable Instrumentation for Stormwater Management,
W86-03829 7B

JANAUER, G. E.
Insoluble Polymeric Contact Disinfectants: An Alternative Approach to Water Disinfection,
W86-03543 5F

JANIK, J. J.
Relationship of Common Dominant Phytoplankton to Water Temperature and Season,
W86-03724 2H

JENSEN, D. A.
Corpus Christi Inner Harbor Water Quality Survey, August 1982,
W86-03440 5B

JEURISSEN, G. F. J.
Joint Hydrogeological Surveys,
W86-03579 6E

JOHNSON, P. G.
Rock Glaciers: Glacial and Non-Glacial Origins,
W86-03698 2C

JOHNSON, R. A.
Hydrogeologic Data from a Test Well at Kathryn Abbey Hanna Park, City of Jacksonville, Florida,
W86-03555 2F

JOHNSON, S. K.
Health and Disease Control for Aquatic Animals in Dredged Material Containment Sites,
W86-03709 5C

JOHNSON, W. B.
Wetland Loss Directly Associated with Canal Dredging in the Louisiana Coastal Zone,
W86-03854 6G

JONES, P. C.
Analysis of Chlorinated Organic Compounds Formed During Chlorination of Wastewater Products,
W86-03496 5A

Size Exclusion, Reverse-Phase and Weak Anion Exchange Chromatography of National Organics in Water,
W86-03815 5A

JORDAN, E.
Glacier Inventory of Bolivia,
W86-03676 2C

JUNK, G. A.
Anionic and Neutral Organic Components in Water by Anion Exchange,
W86-03810 5A

Extraction of Organic Compounds from Water Using Small Amounts of Solvent,
W86-03809 5A

KABELL, T. C.
Sediment Storage Requirements for Reservoirs,
W86-03607 2J

KAGEL, R. O.
Validation and Priority Pollutant Analysis,
W86-03792 5A

KANEKO, A.
Specialized Dredges Designed for Bottom Sediment Dredging,
W86-03469 5G

KASAJIMA, S.
Removal of Bottom Sediments in Osaka Port by the Pneuma Pump Dredge 'Shunkai',
W86-03463 5G

KASSER, P.
Effect of Topographic Orientation on the Variations of Glacier Length,
W86-03700 2C

KATZ, B. G.
Chemical and Microbiological Monitoring of a Sole-Source Aquifer Intended for Artificial Recharge, Nassau County, New York,
W86-03527 5A

KEATING, K. I.
Extracellular Metabolite Involvement in Plankton Community Structure,
W86-03491 2H

KECK, L. A.
Drought-Related Impacts on Municipal and Major Self-Supplied Industrial Water Withdrawals in Tennessee, (Part A and Part B),
W86-03560 6D

KELLER, D. L.
Startup Critique of Sartell 3,
W86-03736 5D

KEMP, G. P.
Mudflat and Marsh Progradation Along Louisiana's Chenier Plain: A Natural Reversal in Coastal Erosion,
W86-03853 2J

KENNEDY, R. H.
State-of-the-Art Summary of Phosphorus Inactivation as a Lake Restoration Technique,
W86-03486 5G

KENNEDY, V. C.
Results of a Solute Transport Experiment at Uvas Creek, September 1972,
W86-03556 2E

KHALID, R. A.
Literature Survey of Reservoir Contaminant Problems,
W86-03623 5B

KICK, W.
Material for a Glacier Inventory of the Indus Drainage Basin - The Nanga Parbat Massif,
W86-03683 2C

KILEWE, A. M.
Approach to Testing the USLE Factor Values in Kenya,
W86-03597 2J

KIMMEL, B. L.
DCMU-Enhanced Chlorophyll Fluorescence as an Indication of the Physiological Status of Reservoir Phytoplankton: An Initial Evaluation,
W86-03721 2H

KINCANNON, D. F.
Treatment of Municipal Wastewaters Containing Biologically Hazardous Industrial Compounds by Conventional Activated Sludge and Extended Aeration,
W86-03889 5D

KINSTLEY, W.
Analysis of Chlorinated Organic Compounds Formed During Chlorination of Wastewater Products,
W86-03496 5A

KITAI, R.
Hydrometeorological Data Acquisition: Innovative, High-Resolution Programmable Instrumentation for Stormwater Management,
W86-03829 7B

KITTLE, J. L.
Application Guide for Hydrological Simulation Program: FORTRAN (HSPF),
W86-03614 2A

KLAPPER, H.
Possibilities of Water Management for Protecting and Treating Drinking Water Resources in Case of Nitrate Pollution,
W86-03654 5G

KLEIN, A. W.
Significance and Limitations of Environmental Compartmentalization Models in the Control of New Chemicals Based on the Organization for

Economic Cooperation and Development Minimum Premarketing Set of Data,
W86-03423 5G

KLEOPFER, R. D.
Priority Pollutant Methodology Quality Assurance Review,
W86-03529 5A

KLIMAS, C. V.
Impacts of Flooding Regime Modification on Wildlife Habitats of Bottomland Hardwood Forests in the Lower Mississippi Valley,
W86-03634 6G

Preliminary Guide to the Onsite Identification and Delineation of the Wetlands of the South Atlantic United States,
W86-03480 2H

KLOCKARS, C. E.
Studies on Groundwater Transport in Fractured Crystalline Rock under Controlled Conditions Using Nonradioactive Tracers,
W86-03497 2F

KOBA, H.
Dispersion of Sediment Resuspension Caused by Dredge Operation,
W86-03873 5B

KODAMA, F.
Restoration Study of Dredging in Lake Ksaumigaura,
W86-03468 5G

KOLLMEYER, R. C.
West Greenland Outlet Glaciers: An Inventory of the Major Iceberg Producers,
W86-03679 2C

KOLTZ, J. R.
Filtrable Solids as a Design Parameter for Wastewater Treatment Processes,
W86-03662 5D

KORSCHGEN, C. E.
Problems on the Upper Mississippi River and Its Tributaries: Need for a Long-Term Resource Monitoring Program,
W86-03751 7A

Water Chemistry at Selected Sites on Pools 7 and 8 of the Upper Mississippi River: A Ten-Year Survey,
W86-03749 5B

KOSAREK, L. J.
Removal of Various Toxic Heavy Metals and Cyanide from Water by Membrane Processes,
W86-03532 5D

KOTAKE, T.
Measurement of Nutrient Concentrations in Sediment Pore Water Collected by a Dialysis Sampler,
W86-03877 5A

KOTLYAKOV, V. M.
Problems and Results of Studies of Mountain Glaciers in the Soviet Union,
W86-03686 2C

Use of the Data of Glacier Inventories for Compilation of the World Atlas of Snow and Ice Resources,
W86-03701 2C

KRAINOV, S. R.
Simulation of Physicochemical Interactions in a Water-Rock System in Assessing Ground-Water Quality,
W86-03759 2K

KRAUSER, R. F.
Alternatives to Open Water Disposal of Contaminated Dredged Material,
W86-03879 5E

KRUSEMAN, G. P.
Joint Hydrogeological Surveys,
W86-03579 6E

KUBOTA, H.
Comparison of Several Methods for Collection and Quantification of Polycyclic Aromatic Hydrocarbons from Aqueous Media,
W86-03812 5A

KUKLA, G. J.
Recent Secular Variations of Snow and Sea Ice Cover,
W86-03695 2C

KULIKOV, G. V.
Simulation of Physicochemical Interactions in a Water-Rock System in Assessing Ground-Water Quality,
W86-03759 2K

KURIMOTO, Y.
Measurement of Nutrient Concentrations in Sediment Pore Water Collected by a Dialysis Sampler,
W86-03877 5A

KURTER, A.
Present Glaciation in Turkey,
W86-03689 2C

KURZ, G. E.
City of Chattanooga Industrial-Municipal Pretreatment Program,
W86-03899 5D

KWAMENA, F. A.
Onshore Impacts of Offshore Hydrocarbon Development: Annotated Bibliography,
W86-03620 5C

LAL, R.
Mulch Requirements for Erosion Control with the No-Till System in the Tropics: A Review,
W86-03600 4D

Testing the Applicability of a Soil Erodibility Nomogram for Some Tropical Soils,
W86-03599 2J

LAMBOU, V. W.
Effect of Light Attenuation on the Relationship of Phytoplankton Biomass to Phosphorus Levels,
W86-03726 2H

Relationship of Common Phytoplankton Genera to Nutrients in Eastern and Southeastern Lakes,
W86-03725 2H

LANDINE, R. C.
Anaerobic Pretreatment Facility Also Provides Sludge Disposal Capability and Source of Renewable Energy for Food Processor,
W86-03661 5D

LANDRUM, P. F.
Anomalous Breakthrough of Benzo(A)Pyrene during Concentration with Amberlite XAD-4 Resin from Aqueous Solutions,
W86-03813 5A

LANG, H.
View on Our Knowledge of Water Resources in Relation to Climate in the Alps,
W86-03847 2B

LANIER, J. A.
Aquaculture Thesaurus: Descriptors Used in the National Aquaculture Information System,
W86-03643 10C

LANTZ, J. B.
Development of a TOC/COD Analyzer for Process Applications,
W86-03526 5A

LARDNER, J. P.
Evaluating the Use of Depth-Frequency Equations for Enforcing Local Floodplain Regulations,
W86-03450 2E

LARSON, L. R.
Time of Travel and Dispersion of Solutes in a 36.4-Mile Reach of the North Platte River Downstream from Casper, Wyoming,
W86-03559 2E

LASSITER, R. R.
Testing Models of the Fate of Chemicals in Aquatic Environments,
W86-03430 5B

LATVALA, A.
Rapid Filtration as a Supplementary Treatment of Domestic Sewage,
W86-03843 5D

LAUTERBACH, D.
Possibilities of Water Management for Protecting and Treating Drinking Water Resources in Case of Nitrate Pollution,
W86-03654 5G

LAWLEY, G.
Nitrogen Fixation and Phytoplankton Interactions in Southwestern Reservoirs,
W86-03720 2H

LAWRENCE, F. L.
Aquaculture Thesaurus: Descriptors Used in the National Aquaculture Information System,
W86-03643 10C

LEUSINK, A.
Isotope Studies as a Final Stage in Groundwater Investigations on the African Shield,
W86-03574 2F

LEVINE, A. D.
Filtrable Solids as a Design Parameter for Wastewater Treatment Processes,
W86-03662 5D

LEWIS, W. J.
Performance of Sanitary Completion Measures of Wells and Boreholes Used for Rural Water Supplies in Malawi,
W86-03582 5G

LI, C-C.
Distribution, Features and Variations of Glaciers in China,
W86-03684 2C

Recent Research on Glaciers on the Chinhai-Tibet Plateau,
W86-03685 2C

LI, R-M.
Investigation of Effects of Navigation Traffic Activities on Hydrologic, Hydraulic, and Geomorphic Characteristics in the Upper Mississippi River System,
W86-03750 5B

LIEU, F-Y.
Part-per-Trillion Analysis of Volatile, Base/Neutral and Acidic Water Contaminants on a Single Fused-Silica Capillary Column,
W86-03801 5A

LIGHT, W. G.
Removal of Chemical Carcinogens from Water/Wastewater by Reverse Osmosis,
W86-03536 5D

LITTLE, L. W.
Investigation on the Suitability of Various Pesticide Manufacturing Wastewater for Discharge to Municipal Waste Treatment Facilities,
W86-03900 5D

LIU, H. L.
Demonstration of a Cross-Flow Microfiltration System from the Removal of Toxic Heavy Metals from Battery Manufacturing Wastewater Effluents,
W86-03533 5D

LO, T. Y.
Groundwater Contamination and Emergency Response Guide,
W86-03457 5G

LONGLEY, K. E.
Reduction of Trihalomethane Production with Optimal Disinfection Through Alternative Disinfection Systems,
W86-03542 5F

LORENZEN, M. W.
Aeration/Circulation for Control of Algal Production,
W86-03487 2G

LOSKOT, C. L.
Geologic and Hydrologic Data from a Test-Drilling Program in the High Plains Areas of South Dakota, 1979-1980,
W86-03558 2F

LOVELAND, W. D.
Stable Activable Tracers for Environmentally Significant Organic Molecules,
W86-03805 5A

LUNZ, J. D.
Beneficial Uses of Dredged Material: Aquaculture in Dredged Material Containment Areas,
W86-03882 5E

LUOMA, S. N.
Contaminants in the Upper Mississippi River: Summary and Conclusions,
W86-03752 6G

LUTCHER, T. J.
Understanding the Application of Analytical Data to Process Control,
W86-03730 5D

LYMAN, W. J.
Groundwater Contamination and Emergency Response Guide,
W86-03457 5G

LYTLE, J. S.
Pollutant Transport in Mississippi Sound: Interim Technical Report III,
W86-03839 5B

LYTLE, T. F.
Pollutant Transport in Mississippi Sound: Interim Technical Report III,
W86-03839 5B

MACKAY, D.
Evaluative Model for Estimating Environmental Fate,
W86-03424 5B

MAIER, W. J.
Determination of Carbohydrates and Primary Amines in River Water,
W86-03524 5A

Ultraviolet Multiwavelength Absorbance Measurements for Monitoring Trace Organics in Water,
W86-03525 5A

MAJANGA, F. I.
Water Resources Assessment Study in Kiambu District, Kenya,
W86-03571 2F

MAKAREVICH, K. G.
Studies of Glacier Fluctuations in the USSR,
W86-03687 2C

MAKHOALIBE, S.
Suspended Sediment Transport Measurement in Lesotho,
W86-03587 2J

MALLARD, G. E.
Chemical and Microbiological Monitoring of a Sole-Source Aquifer Intended for Artificial Recharge, Nassau County, New York,
W86-03527 5A

MANICKAM, T. S.
Treatment of Municipal Wastewaters Containing Biologically Hazardous Industrial Compounds by Conventional Activated Sludge and Extended Aeration,
W86-03889 5D

MANSKY, J. M.
Capping of Dredged Material Disposal Management for New York Harbor,
W86-03464 5G

MAPEL, D.
Further Optimization of the Pentane Liquid-Liquid Extraction Method for the Analysis of Trace Organic Compounds in Water,
W86-03808 5A

MAR, B. W.
Predictive Model for Highway Runoff Pollutant Concentrations and Loadings,
W86-03834 2A

MARCHAND, D.
Lead and Cadmium in Precipitation in the Essex Region of Southwestern Ontario,
W86-03772 5B

MARKLE, D. G.
Revetment Stability Study, Fort Fisher State Historic Site, North Carolina: Hydraulic Model Investigation,
W86-03479 8A

MARKO, J. R.
Deep-Water Blowout Trajectory Models for the Lancaster Sound Region,
W86-03638 5B

MARTIN, C. O.
Impacts of Flooding Regime Modification on Wildlife Habitats of Bottomland Hardwood Forests in the Lower Mississippi Valley,
W86-03634 6G

MASCHWITZ, D. E.
Establishment of an Ammonia Effluent Limitation for the Twin Cities Metro Plant,
W86-03748 5B

MASKARINEC, M. P.
Comparison of Several Methods for Collection and Quantification of Polycyclic Aromatic Hydrocarbons from Aqueous Media,
W86-03812 5A

MASSABUAU, J. C.
Physico-Chemical Characteristics of Surface Waters and Hydrological Behavior of a Small Granitic Basin (Vosges Massif, France): Annual and Daily Variations,
W86-03775 5B

Respiratory Gas Content (O2 and CO2) and Ionic Composition of River Water in the Plain of Alsace (Eastern France),
W86-03763 2F

MATTHESS, G.
Interaction Water-Silicate Minerals in the Unsaturated Zone Controlled by Thermodynamic Disequilibria,
W86-03756 2K

Role of Natural Organics on Water Interaction with Soil and Rock,
W86-03754 2K

MAY, T. W.
Longitudinal Distribution of Trace Elements (As, Cd, Cr, Hg, Pb, and Se) in Fishes and Sediments in the Upper Mississippi River,
W86-03743 5B

MCCONNELL, J. B.
Inland Travel of Tide-Driven Saline Water in the Altamaha and Satilla Rivers, Georgia, and the St. Marys River, Georgia-Florida,
W86-03561 2L

MCCONVILLE, D. R.
Heavy Metal Accumulation in Selected Sessile Components of Fountain City Bay, Pool 5A, of the Upper Mississippi River,
W86-03744 5B

MCCUTCHEON, S. C.
Evaluation of Selected One-Dimensional Stream Water-Quality Models with Field Data,
W86-03644 5B

MCDIARMID, R. W.
Large-Scale Operations Management Test of Use of the White Amur for Control of Problem Aquatic Plants, Report 1: Baseline Studies, Volume V, The Herpetofauna of Lake Conway, Florida,
W86-03458 2H

MCHENRY, J. R.
Recent Rates of Sedimentation in the Mississippi River,
W86-03741 2J

MCINERNEY, J.
1981 CCOPE PROBE Mesonet Calibration and Maintenance Procedures,
W86-03481 7B

MCKELVIE, S. A.
Preparing a Design Storm,
W86-03833 2A

MCKENZIE, D. H.
Procedure for Developing Biological Input for the Design, Location, or Modification of Water-Intake Structures,
W86-03519 8I

MCKEOWN, J. J.
Assessment of the Measurement Uncertainty in the Estimation of Stream Reaeration Rate Coefficients Using Direct Tracer Techniques,
W86-03824 5A

Study of the Selection, Calibration and Verification of Mathematical Water Quality Models,
W86-03823 5B

MCLEOD, D. W.
Investigations of Large Scale Storm Systems: Final Report,
W86-03647 2B

MEDINA, R.
Site Description of Dredged Material Containment Areas: An Overview of Physical, Chemical, Biological Features,
W86-03705 2H

MENDELSSOHN, I. A.
Sand Dune Vegetation and Stabilization in Louisiana,
W86-03864 2J

MENEGHINI, R.
Multi-Parameter Remote Measurement of Rainfall,
W86-03618 2B

MESSERLI, B.
Mountain Glaciers in the Mediterranean Area and in Africa,
W86-03691 2C

MEYER, J. S.
Complex Effluent Fate Modeling,
W86-03429 5B

MICHAEL, L. C.
Master Analytical Scheme: Development of Effective Techniques for Isolation and Concentration of Organics in Water,
W86-03794 5A

Quality of Master Analytical Scheme Data: Purgeables and Volatile Organic Acids,
W86-03797 5A

Quantitative Aspects of the Master Analytical Scheme for Organics in Water,
W86-03796 5A

MICHAIL, M.
Gross Organics Measurements for Monitoring of Wastewater Treatment and Reuse,
W86-03523 5A

MIDDLETON, B.
Sediment Yield Estimation and the Design of Sediment Control Structures in Rural Africa,
W86-03595 4D

MILES, D. L.
Comparative Study of Sequential Redox Processes in Three British Aquifers,
W86-03758 2F

MILLER, H.
Development of Methods for Pesticides in Wastewater: Applicability of a General Approach,
W86-03798 5A

MILLER, J. E.
Evaluation of Future Base-Flow Water-Quality Conditions in the Hillsborough River, Florida,
W86-03546 5B

MILLER, S. J.
Statistical Summaries of Streamflow Data in Oregon; Volume 1 Eastern Oregon,
W86-03550 2E

MILLIGAN, D.
Selection Criteria and Procedures for Establishing Mariculture Facilities in Existing Containment Sites,
W86-03712 5C

MILLINGTON, A. C.
Indigenous Soil Conservation Studies in Sierra Leone,
W86-03603 4D

Remote Sensing Applications in African Erosion and Sedimentation Studies,
W86-03592 7B

MILLS, P. E.
Quality Assurance in the Evaluation of Pollution Control Technology: Experiences at the Industrial Environmental Research Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio,
W86-03530 5A

MIMAKI, T.
Boundary Conditions of Sediment Surfaces Viewed from DO Behavior,
W86-03467 2H

MINTON, R. V.
Pond Design and Management for Coastal Aquaculture,
W86-03710 2H

MITREGA, J.
Hydrochemical Budgeting in Studies of Ground-Water Renewability in Areas of Glacial Formation Systems,
W86-03783 2F

MONCUR, J. G.
Part-per-Trillion Analysis of Volatile, Base/Neutral and Acidic Water Contaminants on a Single Fused-Silica Capillary Column,
W86-03801 5A

MONNING, E. C.
Investigation on the Suitability of Various Pesticide Manufacturing Wastewater for Discharge to Municipal Waste Treatment Facilities,
W86-03900 5D

MONTGOMERY, R. L.
Overview of Corps Research Program on Dredging Contaminated Sediments,
W86-03472 5G

MOO-YOUNG, M.
Comparison of Stirred Suspension and Fixed Film Anaerobic Digestion Systems,
W86-03668 5D

MOORE, B. E.
Reduction of Trihalomethane Production with Optimal Disinfection Through Alternative Disinfection Systems,
W86-03542 5F

MOORE, J. G.
Innovation in Wastewater Treatment,
W86-03884 5D

MORTON, R. A.
Effects of Coastal Structures on Shoreline Stabilization and Land Loss - The Texas Experience,
W86-03863 2L

MOSELEY, M. A.
High-Resolution Gas Chromatography and Negative Ion Chemical Ionization Mass Spectrometry of Polychlorinated Biphenyls,
W86-03803 5A

MULDER, J.
Hydrochemical Budgets of Some Dutch Woodland Soils with High Inputs of Atmospheric Acid Deposition: Mobilization of Aluminum,
W86-03774 5B

MULLER, F.
Parameterization of Glacier Equilibrium Line Altitude,
W86-03696 2C

Present and Late Pleistocene Equilibrium Line Altitudes in the Mt Everest Region - An Application of the Glacier Inventory,
W86-03681 2C

Some Comments on the Swiss Glacier Inventory,
W86-03690 2C

MULLIN, M. D.
Analysis of Polychlorinated Biphenyls by Glass Capillary and Packed-Column Chromatography,
W86-03802 5A

MURPHY, E. M.
Instrumentation and Methods Evaluations for Shallow Land Burial of Waste Materials: Water Erosion,
W86-03510 5E

MURPHY, K. L.
Evaluation of Biological Nitrification-Denitrification at Penticton, British Columbia,
W86-03619 5D

NAGY, E.
Fate of Oil and Dispersant Mixtures in Freshwater,
W86-03637 5B

NAKAMURA, M.
Rapid Dewatering Test of Dredged Material In Situ,
W86-03871 5D

NATIV, R.
Hydrochemical Relationships Between Rainwater, Floods, Groundwater and Lithology in the Avedat Group on the Negev Highlands, Israel,
W86-03789 2A

NATORI, M.
Theoretical Consideration of Pond and Spillwater Treatment Design,
W86-03876 5G

NEELY, W. B.
Evaluative Model for Estimating Environmental Fate,
W86-03424 5B

NEITZEL, D. A.
Procedure for Developing Biological Input for the Design, Location, or Modification of Water-Intake Structures,
W86-03519 8I

NELSON, D. W.
Utilization of Sewage Sludges on Cropland,
W86-03897 5E

NEUROHR, G. A.
Use of Aquatic Macrophytes for Sludge Treatment,
W86-03669 5D

NIELSEN, D. N.
Sediments of the Upper Mississippi River: Their Sources, Distribution, and Characteristics,
W86-03740 2J

NIKADO, K.
Dredging and Management Problems in Lake Suwa,
W86-03462 5G

NIKANOROV, A. M.
Study of the Hydrochemical Regime and Its Long-Term Variations in the Case of Some Rivers in U.S.S.R.,
W86-03778 2K

NOLL, R. M.
Fate and Transport Modeling for Toxic Substances,
W86-03425 5B

NORMANN, J. M.
Chimney Hill Off-Site Drainage Study,
W86-03835 2A

NORVELL, W. A.
Chemical and Physical Properties of Connecticut Lakes,
W86-03438 2H

NOSEK, J. A.
Polychlorinated Biphenyls and Organochlorine Insecticides in Great Blue Heron and Great Egret Eggs from the Upper Mississippi River,
W86-03747 5B

NULTON, C. P.
Microextraction as an Approach to Analysis for Priority Pollutants in Industrial Wastewater,
W86-03806 5A

NUMMEDAL, D.
Future Sea Level Changes Along the Louisiana Coast,
W86-03862 2L

O'CONNOR, D. J.
Simplified Model of the Fate of Partitioning Chemicals in Lakes and Streams,
W86-03426 5B

O'CONNOR, J. M.
Eco-Kinetic Model for the Accumulation of PCB in Marine Fishes,
W86-03475 5B

O'CONNOR, K. F.
Present and Potential Use of Micro-Hydro-Electric Schemes in Remote Locations,
W86-03505 8A

O'ROURKE, J. T.
Water Recycling in the Pulp and Paper Industry in California,
W86-03437 3E

OAKES, D. B.
Nitrate Pollution of Groundwater Resources: Mechanisms and Modelling,
W86-03656 5B

OBERHOLTZER, J. E.
Evaluation of the Microextraction Technique to Analyze Organics in Water,
W86-03807 5A

OFUJI, I.
New Techniques Developed in Japan for Oil Spill Cleanup,
W86-03875 5B

OGAWA, I.
Extraction of Organic Compounds from Water Using Small Amounts of Solvent,
W86-03809 5A

OHATA, T.
Glacier Inventory in the Dudh Kosi Region, East Nepal,
W86-03682 2C

OHMURA, A.
Regional Water Balance in the Mountainous Arctic and Its Application for Water-Resource Planning,
W86-03849 2D

OHSE, W.
Interaction Water-Silicate Minerals in the Unsaturated Zone Controlled by Thermodynamic Disequilibria,
W86-03756 2K

OKADA, M.
Comparison of Methods for Estimating Nutrient Release from Lake Sediments,
W86-03477 5B

Hypolimnetic Oxygen Deficit in a Eutrophic Lake and the Role of Sediment Oxygen Demand,
W86-03869 5C

OKPOKO, E. I.
Gully Erosion in the Agulu-Nanka Region of Anambra State, Nigeria,
W86-03589 2J

OLIVIERI, V. P.
Biological Evaluation of Methods for the Determination of Free Available Chlorine,
W86-03539 5A

OMMANNEY, C. S. L.
Inventory of Canadian Glaciers: Procedures, Techniques, Progress and Applications,
W86-03677 2C

OMORINBOLA, E. O.
Groundwater Resources in Tropical African Regoliths,
W86-03564 2F

ONISHI, Y.
Mathematical Model, SERATRA, for Sediment-Contaminant Transport in Rivers and Its Application to Pesticide Transport in Four Mile and Wolf Creeks in Iowa,
W86-03648 5B

User's Manual for EXPLORE-I: A River Basin Water Quality Model, Hydraulic Module Only,
W86-03646 2A

User's Manual for the Instream Sediment-Contaminant Transport Model SERATRA,
W86-03630 5B

ONSTAD, C. A.
Approach to Testing the USLE Factor Values in Kenya,
W86-03597 2J

OOSTERBAAN, W. A.
Hydrochemistry of Springs from Dolomite Reefs in the Southern Alps of Northern Italy,
W86-03765 2K

OTERI, A. U.
Electric Logs for Groundwater Exploration in the Niger Delta.
W86-03570 2F

OWENS, E. H.
Canadian Inland Waters: Coastal Environments and the Cleanup of Oil Spills,
W86-03621 5G

PACES, T.
Mass-Balance Approach to the Understanding of Geochemical Processes in Aqueous Systems,
W86-03773 5B

PACHLA, J.
Hydrochemical Budgeting in Studies of Ground-Water Renewability in Areas of Glacial Formation Systems,
W86-03783 2F

PALING, W. A. J.
Optimization of Conjunctive Use of Groundwater and Surface Water Resources in the Vaal Basin,
W86-03573 4B

PALMER, F. H.
Polychlorinated Biphenyls (PCBs),
W86-03446 5G

PANKEY, J. M.
Streamflow Summaries from Twelve Tributaries of Farmington Creek, Davis County Experimental Watershed, Northern Utah,
W86-03640 2A

PARK, R. A.
Modeling Combined Effects of Environmental Factors on Phytoplankton,
W86-03718 2H

PASHKEVITCH, V.
Changes in Ground-Water Chemical Composition in Drained Peat Bogs in Connection with Environmental Protection Measures,
W86-03764 2F

PASTOROK, R. A.
Aeration/Circulation for Control of Algal Production,
W86-03487 2G

PATRICK, W. H.
Literature Survey of Reservoir Contaminant Problems,
W86-03623 5B

PAULSRUD, B.
Alkalinity Feed Forward Control of Alum Addition in Wastewater Treatment,
W86-03666 5D

PEKDEGER, A.
Interaction Water-Silicate Minerals in the Unsaturated Zone Controlled by Thermodynamic Disequilibria,
W86-03756 2K

PELLIZZARI, E. D.
High-Resolution Gas Chromatography and Negative Ion Chemical Ionization Mass Spectrometry of Polychlorinated Biphenyls,
W86-03803 5A

Master Analytical Scheme: Development of Effective Techniques for Isolation and Concentration of Organics in Water,
W86-03794 5A

Quantitative Aspects of the Master Analytical Scheme for Organics in Water,
W86-03796 5A

PENLAND, S.
Assessment of Geological and Human Factors Responsible for Louisiana Coastal Barrier Erosion,
W86-03852 2J

PENNINGTON, C. H.
Evaluating Changes in Dike Field Fishes with Community Information Indices,
W86-03628 7A

Evaluation of Community Information Indices for Mississippi River Fisheries,
W86-03499 7C

PERRY, D. L.
Master Analytical Scheme: An Assessment of Factors Influencing Precision and Accuracy of Gas Chromatography/Mass Spectrometry Data,
W86-03795 5A

PETTS, G. E.
Impounded Rivers: Perspectives for Ecological Management,
W86-03516 6G

PFEFFER, J. T.
Nonlinear Programming Model of a Wastewater Treatment System: Sensitivity Analysis and a Robustness Constraint,
W86-03511 5D

PIETARILA, M.
Post-Precipitation in Wastewater Treatment,
W86-03845 5D

PIOT, J.
Runoff, Erosion and Soil Fertility Restoration on the Mossi Plateau (Central Upper Volta),
W86-03601 4D

PITT, J. D.
Impact of Sediment on Reservoir Life,
W86-03604 2J

PIZZA, J. C.
Eco-Kinetic Model for the Accumulation of PCB in Marine Fishes,
W86-03475 5B

PIZZI, G.
Groundwater Management by Means of a Quasi-Three-Dimensional Finite Element Flow Model,
W86-03577 2F

PLAN, B.
Giardiasis in Washington State,
W86-03507 5C

PLEWA, M. J.
Effect of Soil on the Mutagenic Properties of Waste Water,
W86-03502 5C

POLOVINO, H. N.
Evaluating Changes in Dike Field Fishes with Community Information Indices,
W86-03628 7A

Evaluation of Community Information Indices for Mississippi River Fisheries,
W86-03499 7C

POPPE, W. L.
Phytoplankton Effects of Reservoir Use,
W86-03722 5G

PORCELLA, D. B.
Use of Bioassay Approaches for Assessing Phytoplankton Growth in Lakes and Reservoirs,
W86-03723 5C

PORTER, J. J.
Hyperfiltration of Textile Process Water for Reuse,
W86-03535 5D

PORTER, K. G.
Limits to the Control of Algal Populations by Grazing Zooplankton: The Environmental Theater and the Ecological Play,
W86-03489 5G

POUND, C. E.
Land Treatment of Combined Municipal/Industrial Wastewaters,
W86-03896 5D

PRESCOTT, G. W.
Algicides and Algal Management and Control: Bibliography,
W86-03494 5G

Review of Control Measures for Objectional Algal 'Blooms',
W86-03484 5G

PRINCE, K. R.
Streamflow Augmentation at Fosters Brook, Long Island, New York - A Hydraulic Feasibility Study,
W86-03551 4A

QUASEBARTH, T. F.
Use of Continuous Simulation Model Calibration Techniques to Develop Nonpoint Pollution Loading Factors,
W86-03828 5B

RAATS, P. A. C.
Accumulation and Transport of Water and Solutes in the Saturated and Unsaturated Zones,
W86-03784 2F

RABASSA, J.
East-West and North-South Snow Line Gradients in the Northern Patagonian Andes, Argentina,
W86-03674 2C

RADA, R. G.
Distribution and Enrichment of Trace Metals (Cd, Cr, Cu, Ni, Pb, Zn) in Bottom Sediments of Navigation Pools 4 (Lake Pepin), 5 and 9 of the Upper Mississippi River,
W86-03742 5B

Sediments of the Upper Mississippi River: Their Sources, Distribution, and Characteristics,
W86-03740 2J

RADOK, U.
Climatic Background to Some Glacier Fluctuations,
W86-03699 2C

RAMALHO, R. S.
Introduction to Wastewater Treatment Processes,
W86-03455 5D

RANDO, L. C.
Master Analytical Scheme: An Assessment of Factors Influencing Precision and Accuracy of Gas Chromatography/Mass Spectrometry Data,
W86-03795 5A

RAO, N. B.
Fate and Transport Modeling for Toxic Substances,
W86-03425 5B

RATIGAN, B. J.
Determination of Chlorine Dioxide,
W86-03541 5A

RAWLEY, R.
Further Optimization of the Pentane Liquid-Liquid Extraction Method for the Analysis of Trace Organic Compounds in Water,
W86-03808 5A

RAYMOND, G. L.
Overview of Corps Research Program on Dredging Contaminated Sediments,
W86-03472 5G

REEDER, D. J.
Developments in the Analysis of Priority Pollutants by Liquid Chromatography/Mass Spectrometry and Immunoassay Procedures,
W86-03819 5A

REY, Y.
Discharge Forecasting from Glacierized Areas to Optimize Hydroelectric Power Management,
W86-03848 8C

REYNAUD, L.
Can the Linear Balance Model Be Extended to the Whole Alps,
W86-03697 2C

RHODES, J. W.
Microextraction as an Approach to Analysis for Priority Pollutants in Industrial Wastewater,
W86-03806 5A

RICE, R. G.
Review of the Use of Ozone for Improving Combined Municipal/Industrial Wastewater Treatment,
W86-03894 5D

RICHARD, J. J.
Anionic and Neutral Organic Components in Water by Anion Exchange,
W86-03810 5A

RICHARDSON, T. W.
Performance Tests of Pneuma Dredge Pump,
W86-03470 5G

RICHTER, J. C.
Comparison of Soil Moisture Characteristics Predicted by the Arya-Paris Model with Laboratory-Measured Data,
W86-03636 2G

RIJTEMA, P. E.
Effects of Regional Water Management on N-Pollution in Areas with Intensive Agriculture,
W86-03650 5G

RISSMANN, E. F.
Evaluation of the Published Literature in the Water Reuse/Recycle Area,
W86-03521 3E

RITCHIE, J. C.
Recent Rates of Sedimentation in the Mississippi River,
W86-03741 2J

ROBERTS, H. H.
Reversal of Coastal Erosion by Rapid Sedimentation: The Atchafalaya Delta (South-Central Louisiana),
W86-03865 2J

ROBERTS, P. V.
Chlorine Dioxide Chemistry: Generation and Residual Analysis,
W86-03540 5F

ROBINSON, M. A.
Hydrometeorological Data Acquisition: Innovative, High-Resolution Programmable Instrumentation for Stormwater Management,
W86-03829 7B

ROESNER, L. A.
Continuous Simulation of Instream Fecal Coliform Bacteria,
W86-03837 5B

Improved Surcharge Computation, in EXTRAN,
W86-03832 3A

ROMAN, M.
Possibilities of Controlling Nitrate Concentrations in Drinking Water,
W86-03653 5G

ROOSE, E.
Runoff, Erosion and Soil Fertility Restoration on the Mossi Plateau (Central Upper Volta),
W86-03601 4D

ROSECRANCE, A. E.
Determination of Priority Pollutants in Industrial Wastewaters by Stable-Isotope Dilution Gas Chromatography/Mass Spectrometry,
W86-03804 5A

ROSENTHAL, E.
Hydrochemical Relationships Between Rainwater, Floods, Groundwater and Lithology in the Avedat Group on the Negev Highlands, Israel,
W86-03789 2A

ROUSSEAU, P.
Testing the Applicability of a Soil Erodibility Nomogram for Some Tropical Soils,
W86-03599 2J

ROWNEY, A. C.
Continuous Simulation of Instream Fecal Coliform Bacteria,
W86-03837 5B

ROZICH, A. F.
Functional Design of Activated Sludge Processes,
W86-03670 5D

RUBULIS, S.
East-West and North-South Snow Line Gradients in the Northern Patagonian Andes, Argentina,
W86-03674 2C

RUNDQUIST, D. C.
Use of Landsat Digital Information for Assessing Glacier Inventory Parameters,
W86-03702 2C

RUPKE, J. W.
Pollution Control: The Hidden Profit Centre,
W86-03671 5D

RUSSELL, K. W.
Dirty Devil Project: Class II Cultral Resources Inventory in Central Utah,
W86-03518 6G

RYAN, J. F.
Master Analytical Scheme: An Assessment of Factors Influencing Precision and Accuracy of Gas Chromatography/Mass Spectrometry Data,
W86-03795 5A

Master Analytical Scheme: Development of Effective Techniques for Isolation and Concentration of Organics in Water,
W86-03794 5A

RYAN, J. P.
Thermal Desorption from a XAD-4 Adsorption Substrate for Water Analysis by Capillary Gas Chromatography,
W86-03811 5A

RYDING, S-O.
Erosion of Agricultural Land - A Growing Water Quality Problem in Rural Areas,
W86-03780 5B

SACKS, S.
Minimizing Costs by Good Financial Management,
W86-03886 6C

SAKAMOTO, F.
Accumulation of Acrylamide into Fish,
W86-03878 5C

SALBU, B.
Use of Different Physical Separation Techniques for Trace Element Speciation Studies in Natural Waters,
W86-03771 2K

SALEH, F. W.
Size Exclusion, Reverse-Phase and Weak Anion Exchange Chromatography of National Organics in Water,
W86-03815 5A

SAMFIELD, M.
Hyperfiltration of Textile Process Water for Reuse,
W86-03535 5D

SAMSON, S. A.
Use of Landsat Digital Information for Assessing Glacier Inventory Parameters,
W86-03702 2C

SANDERSON, M. E.
Lead and Cadmium in Precipitation in the Essex Region of Southwestern Ontario,
W86-03772 5B

SANTO, J. E.
Demonstration of a Cross-Flow Microfiltration System from the Removal of Toxic Heavy Metals from Battery Manufacturing Wastewater Effluents,
W86-03533 5D

SARTORI, L.
Groundwater Management by Means of a Quasi-Three-Dimensional Finite Element Flow Model,
W86-03577 2F

SATO, A.
Hypolimnetic Oxygen Deficit in a Eutrophic Lake and the Role of Sediment Oxygen Demand,
W86-03869 5C

SATO, E.
Bottom Sediment Dredge 'Clean Up' - Principle and Results -,
W86-03471 5G

SAXENA, R. K.
Surface and Groundwater Mixing and Identification of Local Recharge-Discharge Zones from Seasonal Fluctuations of Oxygen-18 in Groundwater in Fissured Rock,
W86-03790 2F

SCAIFE, W.
Canals and Wetland Erosion Rates in Coastal Louisiana,
W86-03855 6G

SCAVIA, D.
Use and Interpretation of Detailed, Mechanistic Models of Phytoplankton Dynamics,
W86-03719 2H

SCHAFER, D. E.
Calibration of Hydrology and Sediment Transport on Small Agricultural Watersheds Using HSPF,
W86-03825 2J

SCHAFFNER, C.
Determination of Phenolic Water Pollutants by Glass Capillary Gas Chromatography,
W86-03799 5A

SCHARER, J. M.
Comparison of Stirred Suspension and Fixed Film Anaerobic Digestion Systems,
W86-03668 5D

SCHEFFNER, N. W.
Verification of the Chesapeake Bay Model: Chesapeake Bay Hydraulic Model Investigation,
W86-03459 2L

SCHERLER, K.
Some Comments on the Swiss Glacier Inventory,
W86-03690 2C

SCHMIDT-BLEEK, F.
Significance and Limitations of Environmental Compartmentalization Models in the Control of New Chemicals Based on the Organization for Economic Cooperation and Development Minimum Premarketing Set of Data,
W86-03423 5G

SCHMIDTKE, N. W.
Application of Biological Batch Reactor Technology in Wastewater Treatment,
W86-03665 5D

SCHNOOR, J. L.
Fate and Transport Modeling for Toxic Substances,
W86-03425 5B

SCHOLL, J. E.
Continuous DO Response Predicted Using CSPSS Is Verified for Springfield, Missouri,
W86-03826 5B

SCHRODER, J. F.
Special Problems of Glacier Inventory in Afghanistan,
W86-03688 2C

SCHROEDER, D. E.
Correlation of Process Control Strategues with Effluent BOD and Suspended Solids,
W86-03728 5D

SCHULZ, H. D.
Interaction Water-Silicate Minerals in the Unsaturated Zone Controlled by Thermodynamic Disequilibria,
W86-03756 2K

SCOTT, B. F.
Fate of Oil and Dispersant Mixtures in Freshwater,
W86-03637 5B

SCOTT, D. R.
Further Optimization of the Pentane Liquid-Liquid Extraction Method for the Analysis of Trace Organic Compounds in Water,
W86-03808 5A

SCOTT, T. A.
High-Performance Liquid Chromatographic Analysis of Nitrophenols,
W86-03814 5A

High-Performance Liquid Chromatographic Determination of Nitrosamines in Water and Wastewater,
W86-03818 5A

SEKWALE, M.
Hydrogeological Data Collection, Storage, Retrieval and Water Law in Botswana,
W86-03580 7C

SEMKO, D. E.
Human Adaptation Along the Columbia River 4700-1600 BP.: A Report of Test Excavation at River Mile 590, North Central Washington,
W86-03460 6E

SHAN, A.
Development of Methods for Pesticides in Wastewater: Applicability of a General Approach,
W86-03798 5A

SHANAHAN, E. W.
Groundwater Contamination and Emergency Response Guide,
W86-03457 5G

SHAPIRA, N. I.
Demonstration of a Cross-Flow Microfiltration System from the Removal of Toxic Heavy Metals from Battery Manufacturing Wastewater Effluents,
W86-03533 5D

SHAW, L. C.
Hydrology of Area 1, Eastern Coal Province, Pennsylvania,
W86-03547 2E

SHELDON, L. S.
Quality of Master Analytical Scheme Data: Purgeables and Volatile Organic Acids,
W86-03797 5A

Quantitative Aspects of the Master Analytical Scheme for Organics in Water,
W86-03796 5A

SHIH, Y-F.
Distribution, Features and Variations of Glaciers in China,
W86-03684 2C

SHIH, Y-T.
Determination of Carbohydrates and Primary Amines in River Water,
W86-03524 5A

SHIKAMORI, M.
Aeration Effects on Marine Eutrophication,
W86-03868 5G

SHIMIZU, T.
Accumulation of Acrylamide into Fish,
W86-03878 5C

Studies on Analytical Method of Acrylamide Monomer and Accumulation into Fish,
W86-03466 5B

SHIVALINGAIAH, B.
Atmospheric Pollution in Relation to Storm Water Quality Modelling: Literature Review for an Industrial City,
W86-03838 5B

SILVESTON, P. L.
Waterloo Clarifier: Principles and Practice,
W86-03663 5D

SIMMONS, C. S.
Stochastic-Convective Ensemble Method for Representing Dispersive Transport in Groundwater,
W86-03498 5B

SIMONS, D. B.
Investigation of Effects of Navigation Traffic Activities on Hydrologic, Hydraulic, and Geomorphic Characteristics in the Upper Mississippi River System,
W86-03750 5B

SINGH, J.
Estimating Groundwater Recharge Based on Infiltration Characteristics of Layered Soil,
W86-03566 2F

SKAKALSKY, B. G
Study of Anthropogenic Influence on Water Quality in Some Rivers of the Baltic Sea Basin,
W86-03779 5B

SKRENTNER, R. G.
Computer as a Tool for Activated Sludge,
W86-03732 5D

SLIMAK, M. W.
Predictive Fate Models: Their Role in the U.S. Environmental Protection Agency's Water Program,
W86-03421 5B

SMART, G. M.
Predicting the Sediment Capacity of a Channel,
W86-03594 2J

SMART, M. M.
Sediments of the Upper Mississippi River: Their Sources, Distribution, and Characteristics,
W86-03740 2J

SMITH, A.
Surface Erosion and Sediment Control at Open-Cast Mines in Southern Africa,
W86-03602 4D

SMITH-CARINGTON, A. K.
Characteristics of the Weathered Basement Aquifer in Malawi in Relation to Rural Water Supplies,
W86-03568 2F

SMITH, K. L.
Coupled Transport Membranes for Removal of Chromium from Electroplating Rinse Solutions,
W86-03534 5D

SNEAD, M. C.
Biological Evaluation of Methods for the Determination of Free Available Chlorine,
W86-03539 5A

SOMMERS, L. E.
Utilization of Sewage Sludges on Cropland,
W86-03897 5E

SORBER, C. A.
Reduction of Trihalomethane Production with Optimal Disinfection Through Alternative Disinfection Systems,
W86-03542 5F

SOUTHERLAND, E.
Hydrologic Modeling for Studies of Pollutant Loadings and Transport in Large River Basins,
W86-03827 5A

Use of Continuous Simulation Model Calibration Techniques to Develop Nonpoint Pollution Loading Factors,
W86-03828 5B

SOUTHWORTH, R. M.
Industrial Categorical Pretreatment Standards,
W86-03885 5D

SPANE, F. A.
Hydrochemical and Isotopic Content of Basalt Groundwaters Beneath the Hanford Site, Washington,
W86-03517 2K

SPARKES, A. K.
Ground Water in Carbonate Rocks and Regolith in the Fairview Area, Tennessee,
W86-03548 2F

SPARKS, R. E.
Role of Contaminants in the Decline of the Illinois River: Implications for the Upper Mississippi,
W86-03739 6G

SPENCER, H. G.
Hyperfiltration of Textile Process Water for Reuse,
W86-03535 5D

SPRINGER, N. K.
Modeling Chemical Reactions and Transport in Groundwater Systems: A Review,
W86-03428 5B

ST, J. P.
Simplified Model of the Fate of Partitioning Chemicals in Lakes and Streams,
W86-03426 5B

STACK, V. T.
Design of Activated Sludge Facilities for Operating and Maintainability,
W86-03734 5D

STALLINGS, E. A.
Transport of Contaminants from Energy Process Waste Leachates through Subsurface Soils and Soil Components Laboratory Experiments,
W86-03500 5B

STEEVES, A. L.
Anaerobic Pretreatment Facility Also Provides Sludge Disposal Capability and Source of Renewable Energy for Food Processor,
W86-03661 5D

STEFFECK, D. W.
Problems on the Upper Mississippi River and Its Tributaries: Need for a Long-Term Resource Monitoring Program,
W86-03751 7A

STEINNES, E.
Use of Different Physical Separation Techniques for Trace Element Speciation Studies in Natural Waters,
W86-03771 2K

STEVENSON, R. G.
Determination of Chlorine Dioxide,
W86-03541 5A

STEWART, J. A.
Floods of March 1982, Indiana, Michigan, and Ohio,
W86-03552 2E

STICKNEY, R. R.
Review of Species Suitable for Containment Site Culture (Fresh Water),
W86-03706 2H

STINSON, D. L.
Military Hydrology; Report 3: A Review of Army Doctrine on Military Hydrology,
W86-03456 10F

STOCKING, M.
Rates of Erosion and Sediment Yield in the African Environment,
W86-03585 2J

STOUT, R. J.
Assessment of Transport and Fate of Toxic Materials in an Experimental Stream Ecosystem,
W86-03433 5B

STOVER, R. L.
Biological Inhibition Screening of Industrial Wastewaters,
W86-03888 5D

STRANGEWAYS, I.
Low Cost Hydrological Data Collection,
W86-03581 7B

STRAWN, R. K.
Pond Management: Polyculture vs. Monoculture,
W86-03707 2H

STUYFZAND, P. J.
Groundwater Quality Evolution in the Upper Aquifer of the Coastal Dune Area of the Western Netherlands,
W86-03761 2F

SUDO, R.
Comparison of Methods for Estimating Nutrient Release from Lake Sediments,
W86-03477 5B

Hypolimnetic Oxygen Deficit in a Eutrophic Lake and the Role of Sediment Oxygen Demand,
W86-03869 5C

SUMMERS, D. A.
City of Chattanooga Industrial-Municipal Pretreatment Program,
W86-03899 5D

SUNGUR, K.
Present Glaciation in Turkey,
W86-03689 2C

SVEC, H. J.
Extraction of Organic Compounds from Water Using Small Amounts of Solvent,
W86-03809 5A

SWITHINBANK, C.
Problem of a Glacier Inventory of Antarctica,
W86-03693 2C

TAJIMA, S.
Accumulation of Acrylamide into Fish,
W86-03878 5C

TAKASAKI, M.
Hypolimnetic Oxygen Deficit in a Eutrophic Lake and the Role of Sediment Oxygen Demand,
W86-03869 5C

TAKENAKA, S.
Glacier Inventory in the Dudh Kosi Region, East Nepal,
W86-03682 2C

TATEM, H. E.
Aquaculture and Dredged Material Containment Sites: Significance of Contaminated Sediments,
W86-03714 5B

TAVOLARO, J. F.
Alternatives to Open Water Disposal of Contaminated Dredged Material,
W86-03879 5E

TAYLOR, B. A.
Literature Survey of Reservoir Contaminant Problems,
W86-03623 5B

TAYLOR, J. L.
Full Scale Experience with Activated Carbon Treatment of Joint Municipal - Industrial Wastewater,
W86-03892 5D

TAYLOR, W. D.
Effect of Light Attenuation on the Relationship of Phytoplankton Biomass to Phosphorus Levels,
W86-03726 2H

Relationship of Common Dominant Phytoplankton to Water Temperature and Season,
W86-03724 2H

Relationship of Common Phytoplankton Genera to Nutrients in Eastern and Southeastern Lakes,
W86-03725 2H

TCHOBANGLOUS, G.
Filtrable Solids as a Design Parameter for Wastewater Treatment Processes,
W86-03662 5D

TEAFORD, J. W.
Impacts of Flooding Regime Modification on Wildlife Habitats of Bottomland Hardwood Forests in the Lower Mississippi Valley,
W86-03634 6G

TEN HAVEN, H. L.
Geochemical Studies in the Drainage Basin of the Rio Vouga (Portugal). I. General Hydrogeochemistry from Its Origin to the Ria de Aveiro,
W86-03776 2K

TERWEY, J. L.
Isotopes in Groundwater Hydrology,
W86-03575 2F

THERIEN, N.
Relating BOD5 with On-Line Oxygen Uptake Rate Measurements Using Automatic Respirometers in View of Process Monitoring and Control,
W86-03733 5D

THERON, S. J.
Control and Measurement of Organic Micropollutants in South African Water Reclamation Plants,
W86-03522 5A

THIEL, P. A.
Problems on the Upper Mississippi River and Its Tributaries: Need for a Long-Term Resource Monitoring Program,
W86-03751 7A

THOMANN, R. V.
Simplified Model of the Fate of Partitioning Chemicals in Lakes and Streams,
W86-03426 5B

THOMPSON, G.
Impact of Sediment on Reservoir Life,
W86-03604 2J

THOMSON, M. B.
Modeling Chemical Reactions and Transport in Groundwater Systems: A Review,
W86-03428 5B

THRUN, K. E.
Evaluation of the Microextraction Technique to Analyze Organics in Water,
W86-03807 5A

TICHACEK, G.
Induced Change and Its Impact on Aquatic Community Quality in the Sangamon River Basin of Illinois,
W86-03453 5G

Planning Approach for Improved Management of Illinois Streams for Recreation and Conservation,
W86-03452 5G

TIPPS, B. L.
Dirty Devil Project: Class II Cultral Resources Inventory in Central Utah,
W86-03518 6G

TISCHBEIN, P.
Alternatives to Open Water Disposal of Contaminated Dredged Material,
W86-03879 5E

TOLE, M. P.
Some Implication of the Role of Kinetics in Enhancing Element Transport,
W86-03760 2K

TOMER, K. B.
High-Resolution Gas Chromatography and Negative Ion Chemical Ionization Mass Spectrometry of Polychlorinated Biphenyls,
W86-03803 5A

Quantitative Aspects of the Master Analytical Scheme for Organics in Water,
W86-03796 5A

TOMER, K. E.
Master Analytical Scheme: An Assessment of Factors Influencing Precision and Accuracy of Gas Chromatography/Mass Spectrometry Data,
W86-03795 5A

TOPNIK, B. H.
Application of Biological Batch Reactor Technology in Wastewater Treatment,
W86-03665 5D

TOTH, D.
Aerobic Transformation of Nitrogenous Substances in a Freshwater Ecosystem,
W86-03782 5C

TOWNSHEND, J. R. G.
Remote Sensing Applications in African Erosion and Sedimentation Studies,
W86-03592 7B

TRISCHAN, G.
Development of Methods for Pesticides in Wastewater: Applicability of a General Approach,
W86-03798 5A

TRUSSELL, A. R.
Part-per-Trillion Analysis of Volatile, Base/Neutral and Acidic Water Contaminants on a Single Fused-Silica Capillary Column,
W86-03801 5A

TSIRKUNOV, V. V.
Study of the Hydrochemical Regime and Its Long-Term Variations in the Case of Some Rivers in U.S.S.R.,
W86-03778 2K

TUCKER, G. E.
Preliminary Guide to the Onsite Identification and Delineation of the Wetlands of the South Atlantic United States,
W86-03480 2H

TURNER, J. V.
Hydrogeochemical Evolution and Variability of Groundwater in Experimental Basins of S. W. Western Australia,
W86-03757 2F

TURNER, R. E.
Canals and Wetland Erosion Rates in Coastal Louisiana,
W86-03855 6G

Wetland Losses and Coastal Fisheries: An Enigmatic and Economically Significant Dependency,
W86-03859 2L

TWENTER, F. R.
Hydrology and Land Use in Van Buren County, Michigan,
W86-03554 2E

TWINCH, A. J.
Role of Bottom Sediments in Modifying Soluble Phosphate Loads to a Dendritic, Hypertrophic Reservoir,
W86-03787 2J

UBER, J. G.
Nonlinear Programming Model of a Wastewater Treatment System: Sensitivity Analysis and a Robustness Constraint,
W86-03511 5D

ULBRICH, C. W.
Multi-Parameter Remote Measurement of Rainfall,
W86-03618 2B

ULSAKER, L. G.
Approach to Testing the USLE Factor Values in Kenya,
W86-03597 2J

VALENTIN, C.
Evaluation of Factors Influencing Water Erosion in West Africa Using Rainfall Simulation,
W86-03598 2J

VALIMAA, S.
Post-Precipitation in Wastewater Treatment,
W86-03845 5D

VALVE, M.
Combined Nitrogen and Phosphorus Removal from Wastewaters,
W86-03844 5D

VAN, A.
Continuous Monitoring of Rainfall, Streamflow and Suspended Sediment Concentration in Semi-arid Environments,
W86-03591 7B

VAN BREEMEN, N.
Hydrochemical Budgets of Some Dutch Woodland Soils with High Inputs of Atmospheric Acid Deposition: Mobilization of Aluminum,
W86-03774 5B

VAN DER SOMMEN, J.
Isotope Studies as a Final Stage in Groundwater Investigations on the African Shield,
W86-03574 2F

VAN DER WEIJDEN, C. H.
Geochemical Studies in the Drainage Basin of the Rio Vouga (Portugal). I. General Hydrogeochemistry from Its Origin to the Ria de Aveiro,
W86-03776 2K

VAN DONGEN, P. G.
Water Resources Assessment Study in Kiambu District, Kenya,
W86-03571 2F

VAN GRINSVEN, J. J. M.
Hydrochemical Budgets of Some Dutch Woodland Soils with High Inputs of Atmospheric Acid Deposition: Mobilization of Aluminum,
W86-03774 5B

VAN HEERDEN, I. I. I.
Reversal of Corstal Erosion by Rapid Sedimentation: The Atchafalaya Delta (South-Central Louisiana),
W86-03865 2J

VAN LEEUWEN, J.
Treatment of Combined Industrial and Domestic Wastewater for Reuse in South Africa,
W86-03890 5D

VAN RENSBURG, J. F.
Control and Measurement of Organic Micropollutants in South African Water Reclamation Plants,
W86-03522 5A

VAN RENSBURG, J. F. J.
Treatment of Combined Industrial and Domestic Wastewater for Reuse in South Africa,
W86-03890 5D

VAN VUUREN, L. R. J.
Treatment of Combined Industrial and Domestic Wastewater for Reuse in South Africa,
W86-03890 5D

VANELSLANDE, A.
Testing the Applicability of a Soil Erodibility Nomogram for Some Tropical Soils,
W86-03599 2J

VANN, R. G.
Overview of a Dredging Demonstration in Contaminated Material, James River, Virginia,
W86-03474 5G

VARTANYAN, G. S.
Simulation of Physicochemical Interactions in a Water-Rock System in Assessing Ground-Water Quality,
W86-03759 2K

VELIKOV, B. I.
Model Experimental Study of Hydrochemical Processes in the Saturated Zone,
W86-03785 2K

VERDON, J.
Recent Rates of Sedimentation in the Mississippi River,
W86-03741 2J

VERHAGEN, B. T.
Environmental Isotope Hydrology in Southern Africa,
W86-03576 2F

VERSTRATEN, J. M.
Carbon Dioxide in the Soil Atmosphere: Simulation Model Parameter Estimation from Field Measurements,
W86-03755 2G

VOHRA, C. P.
Some Problems of Glacier Inventory in the Himalayas,
W86-03680 2C

VRIEND, S. P.
Geochemical Studies in the Drainage Basin of the Rio Vouga (Portugal). I. General Hydrogeochemistry from Its Origin to the Ria de Aveiro,
W86-03776 2K

WALKER, R. D.
Transport of Contaminants from Energy Process Waste Leachates through Subsurface Soils and Soil Components Laboratory Experiments,
W86-03500 5B

WALLING, D. E.
Sediment Yields of African Rivers,
W86-03584 2J

WANGEN, L. E.
Transport of Contaminants from Energy Process Waste Leachates through Subsurface Soils and Soil Components Laboratory Experiments,
W86-03500 5B

WAPAKALA, W. W.
Estimating Groundwater Recharge Based on Infiltration Characteristics of Layered Soil,
W86-03566 2F

WARD, A.
Sediment Yield Estimation and the Design of Sediment Control Structures in Rural Africa,
W86-03595 4D

Surface Erosion and Sediment Control at Open-Cast Mines in Southern Africa,
W86-03602 4D

WARD, P. R. B.
Solar Powered Groundwater Pumping for Medium Heads,
W86-03583 8C

WARD, R. C.
Water Quality Monitoring: A System's Perspective,
W86-03655 7A

WASCOM, M.
Legal Implications of Coastal Erosion in Louisiana,
W86-03860 6E

WATARI, Y.
Specialized Dredges Designed for Bottom Sediment Dredging,
W86-03469 5G

WATSON, H. K.
Veld Burning and Sediment Yield from Small Drainage Basins,
W86-03588 4D

WATTS, C. D.
Development of Techniques for the Isolation and Identification of Nonvolatile Organics in Drinking Water,
W86-03816 5A

WEAVER, B.
Continuous Monitoring of Rainfall, Streamflow and Suspended Sediment Concentration in Semi-arid Environments,
W86-03591 7B

WEBB, B.
Data Collection for Hydrochemical Balances: Theoretical Aspects,
W86-03766 2A

WEE, V. T.
Determination of Linear Alcohol Ethoxylates in Wastewater and Surface Water,
W86-03821 5A

WEIDICK, A.
Hydrological Basins in West Greenland and Their Relationship to a Preliminary Sectorial Division of the Inland Ice Sheet,
W86-03678 2C

WELCH, E. B.
Control of Non-Point Nutrient Caused Algal Problems Especially by Dilution,
W86-03488 5G

WELLS, J. T.
Mudflat and Marsh Progradation Along Louisiana's Chenier Plain: A Natural Reversal in Coastal Erosion,
W86-03853 2J

WENTZ, S. J.
Drought-Related Impacts on Municipal and Major Self-Supplied Industrial Water Withdrawals in Tennessee, (Part A and Part B),
W86-03560 6D

WESTFALL, R. D.
Induced Change and Its Impact on Aquatic Community Quality in the Sangamon River Basin of Illinois,
W86-03453 5G

Planning Approach for Improved Management of Illinois Streams for Recreation and Conservation,
W86-03452 5G

Relationship Between Stream Recreational Use and Stream Characteristics with Implications for Management of Illinois Streams,
W86-03451 5G

WETZEL, R. G.
Dissolved Organic Matter and Lake Metabolism: Biogeochemistry and Controls of Nutrient Flux Dynamics in Lakes,
W86-03504 2H

WHITE, E.
Developments in the Analysis of Priority Pollutants by Liquid Chromatography/Mass Spectrometry and Immunoassay Procedures,
W86-03819 5A

WHITE, M. M.
DCMU-Enhanced Chlorophyll Fluorescence as an Indication of the Physiological Status of Reservoir Phytoplankton: An Initial Evaluation,
W86-03721 2H

WHITE, W. R.
Feasibility of Flushing Sediments through Reservoirs,
W86-03608 2J

WHITEHOUSE, I. E.
Glacier Snow Line Variations in the Southern Alps, New Zealand,
W86-03692 2C

WHITTEMORE, R. C.
Assessment of the Measurement Uncertainty in the Estimation of Stream Reaeration Rate Coefficients Using Direct Tracer Techniques,
W86-03824 5A

Study of the Selection, Calibration and Verification of Mathematical Water Quality Models,
W86-03823 5B

WIENER, J. G.
Longitudinal Distribution of Trace Elements (As, Cd, Cr, Hg, Pb, and Se) in Fishes and Sediments in the Upper Mississippi River,
W86-03743 5B

WILDER, I.
Emergency Response Equipment to Clean Up Hazardous Chemical Releases at Spills and Uncontrolled Waste Sites,
W86-03476 5G

WILLIAMS, L. R.
Effect of Light Attenuation on the Relationship of Phytoplankton Biomass to Phosphorus Levels,
W86-03726 2H

Relationship of Common Dominant Phytoplankton to Water Temperature and Season,
W86-03724 2H

Relationship of Common Phytoplankton Genera to Nutrients in Eastern and Southeastern Lakes,
W86-03725 2H

WILLIAMS, R. F.
Reduction of Trihalomethane Production with Optimal Disinfection Through Alternative Disinfection Systems,
W86-03542 5F

WILLIAMS, R. S.
Satellite Image Atlas of Glaciers,
W86-03703 2C

WILSON, C. A.
Mariculture in Old Rice Field Impoundments: An Analogy for Dredged Material Containment Areas,
W86-03711 2L

WILSON, R. W.
Evaluation of Biological Nitrification-Denitrification at Penticton, British Columbia,
W86-03619 5D

WINFIELD, B. A.
Potential of Reverse Osmosis for Recycling and Reuse of Sewage Effluents,
W86-03537 5D

WINTER, J. A.
Quality Assurance for Water and Wastewater Analyses,
W86-03528 5A

WISE, S. E.
Mathematical Model, SERATRA, for Sediment-Contaminant Transport in Rivers and Its Application to Pesticide Transport in Four Mile and Wolf Creeks in Iowa,
W86-03648 5B

User's Manual for the Instream Sediment-Contaminant Transport Model SERATRA,
W86-03630 5B

WISEMAN, R.
Quality of Master Analytical Scheme Data: Purgeables and Volatile Organic Acids,
W86-03797 5A

WOOD, W. P.
Role of Environmental Transport and Fate Models in Implementing the Toxic Substances Control Act,
W86-03420 5B

WOODRUFF, D. A.
Calibration of Hydrology and Sediment Transport on Small Agricultural Watersheds Using HSPF,
W86-03825 2J

WOOTEN, J. W.
Preliminary Guide to the Onsite Identification and Delineation of the Wetlands of the South Atlantic United States,
W86-03480 2H

WRIGHT, D.
Onshore Impacts of Offshore Hydrocarbon Development: Annotated Bibliography,
W86-03620 5C

WRIGHT, E. G.
City of Chattanooga Industrial-Municipal Pretreatment Program,
W86-03899 5D

WRIGHT, M. L.
Texas Manufacturing Water Use: Long-Term Projections,
W86-03441 6D

WRIGHT, T. D.
Potential Biological Impacts of Navigation Traffic,
W86-03645 6G

WYCOFF, R. L.
Continuous DO Response Predicted Using CSPSS Is Verified for Springfield, Missouri,
W86-03826 5B

WYNVEEN, R. A.
Development of a TOC/COD Analyzer for Process Applications,
W86-03526 5A

YAMASHITA, I.
Aeration Effects on Marine Eutrophication,
W86-03868 5G

YIN, T-L.
Separation of Boundary Layer and Flow Turbulence of Center-Feed Circular Sedimentation Basins,
W86-03830 5D

YOSHIDA, T.
Boundary Conditions of Sediment Surfaces Viewed from DO Behavior,
W86-03467 2H

Theoretical Considerations of Gravity Dewatering of Dredged Material Through the Bottom of a Containment Area,
W86-03870 5D

YOSHIDA, Y.
Theoretical Consideration of Pond and Spillwater Treatment Design,
W86-03876 5G

YOUNG, G. K.
Calibration of Hydrology and Sediment Transport on Small Agricultural Watersheds Using HSPF,
W86-03825 2J

ZAND, S. M.
Results of a Solute Transport Experiment at Uvas Creek, September 1972,
W86-03556 2E

ZANONI, A. E.
Characteristics and Treatability of Urban Runoff Residuals,
W86-03508 5B

ZEIL, P.
Character of Fractured Rock Aquifers in Eastern Botswana,
W86-03565 2F

ZELLWEGER, G. W.
Results of a Solute Transport Experiment at Uvas Creek, September 1972,
W86-03556 2E

ZIEGLER, F. G.
Legal Validation of Environmental Fate Models,
W86-03434 5G

ZURAWSKI, A.
Ground Water in Carbonate Rocks and Regolith in the Fairview Area, Tennessee,
W86-03548 2F

ZVEREV, V. P.
Evaluation of the Intensity of Some Recent Exogenic Geological Processes in the U.S.S.R. by the Hydrogeochemical Balances Method,
W86-03777 2K

ZWEIDINGER, R.
Investigation on the Suitability of Various Pesticide Manufacturing Wastewater for Discharge to Municipal Waste Treatment Facilities,
W86-03900 5D

ORGANIZATIONAL INDEX

ABCOR, INC., WILMINGTON, MA. WALDEN DIV.
Removal of Chemical Carcinogens from Water/Wastewater by Reverse Osmosis,
W86-03536 5D

ABERDEEN UNIV. (SCOTLAND). DEPT. OF SOIL SCIENCE.
Conditions and Frequency of Sampling for Elucidations of Transport Mechanisms and Element Budgets in Upland Drainage Basins,
W86-03770 7A

ACADEMIA SINICA, LANZHOU (CHINA). LANZHOU INST. OF GLACIOLOGY AND CRYOPEDOLOGY.
Distribution, Features and Variations of Glaciers in China,
W86-03684 2C

Recent Research on Glaciers on the Chinhai-Tibet Plateau,
W86-03685 2C

ADI LTD., FREDERICTON (NEW BRUNSWICK).
Anaerobic Pretreatment Facility Also Provides Sludge Disposal Capability and Source of Renewable Energy for Food Processor,
W86-03661 5D

AGRICULTURAL RESEARCH SERVICE, DURANT, OK. WATER QUALITY AND WATERSHED RESEARCH LAB.
Recent Rates of Sedimentation in the Mississippi River,
W86-03741 2J

AGRICULTURAL RESEARCH SERVICE, MORRIS, MN.
Approach to Testing the USLE Factor Values in Kenya,
W86-03597 2J

AGRICULTURAL UNIV., WAGENINGEN (NETHERLANDS).
Hydrochemical Budgets of Some Dutch Woodland Soils with High Inputs of Atmospheric Acid Deposition: Mobilization of Aluminum,
W86-03774 5B

AIR FORCE GEOPHYSICS LAB., HANSCOM AFB, MA.
Investigations of Large Scale Storm Systems: Final Report,
W86-03647 2B

AKADEMIYA NAUK SSSR, MOSCOW.
Problems and Results of Studies of Mountain Glaciers in the Soviet Union,
W86-03686 2C

Use of the Data of Glacier Inventories for Compilation of the World Atlas of Snow and Ice Resources,
W86-03701 2C

AKADEMIYA NAUK SSSR, MOSCOW. GEOLOGICHESKII INST.
Evaluation of the Intensity of Some Recent Exogenic Geological Processes in the U.S.S.R. by the Hydrogeochemical Balances Method,
W86-03777 2K

AKADEMIYA NAVUK BSSR, MINSK.
Changes in Ground-Water Chemical Composition in Drained Peat Bogs in Connection with Environmental Protection Measures,
W86-03764 2F

Reliability of Information in Hydrogeochemical Investigations,
W86-03769 7A

ALABAMA AGRICULTURAL EXPERIMENT STATION, AUBURN.
Pond Management: Water Quality Criteria and Control,
W86-03708 5G

ALABAMA DEPT. OF CONSERVATION AND NATURAL RESOURCES, GULF SHORES. CLAUDE PETEET MARICULTURE CENTER.
Pond Design and Management for Coastal Aquaculture,
W86-03710 2H

ALGAE ACRES, MCFARLAND, WI.
Selective Algicides,
W86-03485 5G

ALLGEMEINE ELEKTRICITAETS-GESELLSCHAFT AEG TELEFUNKEN, FRANKFURT AM MAIN (GERMANY, F.R.).
High-Performance Liquid Chromatographic Analysis of Nitrophenols,
W86-03814 5A

AMES LAB., IA.
Extraction of Organic Compounds from Water Using Small Amounts of Solvent,
W86-03809 5A

Anionic and Neutral Organic Components in Water by Anion Exchange,
W86-03810 5A

Thermal Desorption from a XAD-4 Adsorption Substrate for Water Analysis by Capillary Gas Chromatography,
W86-03811 5A

AMSTERDAM UNIV. (NETHERLANDS). LAB. FOR PHYSICAL GEOGRAPHY AND SOIL SCIENCE.
Carbon Dioxide in the Soil Atmosphere: Simulation Model Parameter Estimation from Field Measurements,
W86-03755 2G

ANAMBRA STATE UNIV. OF TECHNOLOGY, AWKA (NIGERIA). DEPT. OF EARTH SCIENCES.
Gully Erosion in the Agulu-Nanka Region of Anambra State, Nigeria,
W86-03589 2J

ANDERSON-NICHOLS AND CO., INC., PALO ALTO, CA.
Field Validation and Error Analysis of Chemical Fate Models,
W86-03431 5B

Application Guide for Hydrological Simulation Program: FORTRAN (HSPF),
W86-03614 2A

ANG COAL GASIFICATION CO., DETROIT, MI.
Wastewater Treatment System for a Lurgi Coal Gasification Plant,
W86-03639 5D

ARCTIC SCIENCES LTD., SIDNEY (BRITISH COLUMBIA).
Deep-Water Blowout Trajectory Models for the Lancaster Sound Region,
W86-03638 5B

ARMY ENGINEER DISTRICT, GALVESTON, TX.
Site Description of Dredged Material Containment Areas: An Overview of Physical, Chemical, Biological Features,
W86-03705 2H

Legal Environment of a Containment Site: Laws Governing the Acquisition, Maintenance, and Operation of Dredged Material Disposal Sites,
W86-03715 6E

ARMY ENGINEER DISTRICT, NEW YORK.
Capping of Dredged Material Disposal Management for New York Harbor,
W86-03464 5G

Alternatives to Open Water Disposal of Contaminated Dredged Material,
W86-03879 5E

ARMY ENGINEER DISTRICT, NORFOLK, VA.
Overview of a Dredging Demonstration in Contaminated Material, James River, Virginia,
W86-03474 5G

ARMY ENGINEER INST. FOR WATER RESOURCES, FORT BELVOIR, VA.
Management of Bottom Sediments Containing Toxic Sustances: Proceedings of the 8th U.S./Japan Experts Meeting,
W86-03461 5G

Management of Bottom Sediments Containing Toxic Substances: Proceedings of the 9th US/Japan Experts Meeting.
W86-03867 5G

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS.
Aquaculture and Dredged Material Containment Sites: Significance of Contaminated Sediments,
W86-03714 5B

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS. ENVIRONMENTAL LAB.
Military Hydrology; Report 3: A Review of Army Doctrine on Military Hydrology,
W86-03456 10F

Overview of Corps Research Program on Dredging Contaminated Sediments,
W86-03472 5G

Preliminary Guide to the Onsite Identification and Delineation of the Wetlands of the South Atlantic United States,
W86-03480 2H

Preliminary Guide to the Onsite Identification and Delineation of the Wetlands of the Interior United States.
W86-03482 2H

Impacts of Flooding Regime Modification on Wildlife Habitats of Bottomland Hardwood Forests in the Lower Mississippi Valley,
W86-03634 6G

Effects of Fluctuating Reservoir Water Levels on Fisheries, Wildlife, and Vegetation: Summary of a Workshop, 24-26 February 1981,
W86-03642 6G

Potential Biological Impacts of Navigation Traffic,
W86-03645 6G

Aquaculture in Dredged Material Containment Areas: Proceedings,
W86-03704 2H

Beneficial Uses of Dredged Material: Aquaculture in Dredged Material Containment Areas,
W86-03882 5E

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS. HYDRAULICS LAB.
Verification of the Chesapeake Bay Model: Chesapeake Bay Hydraulic Model Investigation,
W86-03459 2L

Performance Tests of Pneuma Dredge Pump,
W86-03470 5G

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS. HYDRAULICS

Revetment Stability Study, Fort Fisher State Historic Site, North Carolina: Hydraulic Model Investigation,
W86-03479 8A

ARTHUR TECHNOLOGY, INC., FOND DU LAC, WI.
Process Control Strategies,
W86-03729 5D

BATTELLE PACIFIC NORTHWEST LABS., RICHLAND, WA.
Stochastic-Convective Ensemble Method for Representing Dispersive Transport in Groundwater,
W86-03498 5B

Procedure for Developing Biological Input for the Design, Location, or Modification of Water-Intake Structures,
W86-03519 8I

User's Manual for the Instream Sediment-Contaminant Transport Model SERATRA,
W86-03630 5B

User's Manual for EXPLORE-I: A River Basin Water Quality Model, Hydraulic Module Only,
W86-03646 2A

Mathematical Model, SERATRA, for Sediment-Contaminant Transport in Rivers and Its Application to Pesticide Transport in Four Mile and Wolf Creeks in Iowa,
W86-03648 5B

BEAK CONSULTANTS LTD., VANCOUVER (BRITISH COLUMBIA).
Stripping Kraft Foul Condensates with Waste Gases,
W86-03624 5D

BEND RESEARCH, INC., OR.
Coupled Transport Membranes for Removal of Chromium from Electroplating Rinse Solutions,
W86-03534 5D

BERN UNIV. (SWITZERLAND). GEOGRAPHISCHES INST.
Mountain Glaciers in the Mediterranean Area and in Africa,
W86-03691 2C

BINNIE AND PARTNERS, LONDON (ENGLAND).
Impact of Sediment on Reservoir Life,
W86-03604 2J

BKH CONSULTING ENGINEERS, THE HAGUE (NETHERLANDS).
Isotopes in Groundwater Hydrology,
W86-03575 2F

BONNEVILLE POWER ADMINISTRATION, PORTLAND, OR.
Oil Stop Valve: Oil Spill Containment Research and Development Project,
W86-03627 5G

BOTSWANA GEOLOGICAL SURVEY, LOBATSE.
Hydrogeological Data Collection, Storage, Retrieval and Water Law in Botswana,
W86-03580 7C

BRITISH ANTARCTIC SURVEY, CAMBRIDGE (ENGLAND).
Problem of a Glacier Inventory of Antarctica,
W86-03693 2C

BRITISH GEOLOGICAL SURVEY, WALLINGFORD (ENGLAND).
African Groundwater Development-The Challenges for Hydrogeological Science,
W86-03563 2F

Character of Fractured Rock Aquifers in Eastern Botswana,
W86-03565 2F

Characteristics of the Weathered Basement Aquifer in Malawi in Relation to Rural Water Supplies,
W86-03568 2F

Comparative Study of Sequential Redox Processes in Three British Aquifers,
W86-03758 2F

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD, SACRAMENTO. TOXIC SUBSTANCES CONTROL PROGRAM.
Polychlorinated Biphenyls (PCBs),
W86-03446 5G

Rice Herbicides: Molinate (Ordram) and Thiobencarb (Bolero),
W86-03447 5G

CALIFORNIA UNIV., BERKELEY.
Currents in San Pablo Bay,
W86-03449 2L

CALIFORNIA UNIV., BERKELEY. DEPT. OF CIVIL ENGINEERING.
Currents in Suisun Bay,
W86-03448 2L

CALIFORNIA UNIV., DAVIS. DEPT. OF AGRICULTURAL ECONOMICS.
Integrated Physical-Economic Systems Analysis of Irrigated Agriculture,
W86-03658 5G

CALIFORNIA UNIV., DAVIS. DEPT. OF CIVIL ENGINEERING.
Filtrable Solids as a Design Parameter for Wastewater Treatment Processes,
W86-03662 5D

Correlation of Process Control Strategues with Effluent BOD and Suspended Solids,
W86-03728 5D

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF PLANT PATHOLOGY.
Cyanophages: Are They Potential Biological Control Agents of Nuisance Blue-Green Algae,
W86-03492 2H

CAMP, DRESSER AND MCKEE, INC., ANNANDALE, VA.
Improved Surcharge Computation, in EXTRAN,
W86-03832 3A

CAMP, DRESSER AND MCKEE, INC., BOSTON, MA.
Calibration of Hydrology and Sediment Transport on Small Agricultural Watersheds Using HSPF,
W86-03825 2J

CAMP, DRESSER AND MCKEE, INC., SAN FRANCISCO, CA.
Water Recycling in the Pulp and Paper Industry in California,
W86-03437 3E

CANADA CENTRE FOR INLAND WATERS, BURLINGTON (ONTARIO).
Fate of Oil and Dispersant Mixtures in Freshwater,
W86-03637 5B

CANONIE ENGINEERS, CHESTERTON, IN.
Subsurface Investigation for Dredging Projects,
W86-03881 7A

CANTERBURY UNIV., CHRISTCHURCH (NEW ZEALAND). DEPT. OF CIVIL ENGINEERING.
Mathematical Analysis of Groundwater Resources,
W86-03478 2F

CENTRAL CHEMICAL LAB., LUCKNOW (INDIA).
Temporal Changes in Ground Water Quality in the Phreatic Zone Uttar Pradesh (India) and Their Impact on Sampling Schedule,
W86-03768 2F

Water Quality and Water Pollution Problems on the Indian Sub-Continent,
W86-03781 5B

CENTRAL WASHINGTON UNIV., ELLENSBURG.
Human Adaptation Along the Columbia River 4700-1600 BP.: A Report of Test Excavation at River Mile 590, North Central Washington,
W86-03460 6E

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, STRASBOURG (FRANCE). CENTRE DE SEDIMENTOLOGIE ET DE GEOCHIMIE DE LA SURFACE.
Physico-Chemical Characteristics of Surface Waters and Hydrological Behavior of a Small Granitic Basin (Vosges Massif, France): Annual and Daily Variations,
W86-03775 5B

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, STRASBOURG (FRANCE). LAB. DE PHYSIOLOGIE RESPIRATOIRE.
Respiratory Gas Content (O2 and CO2) and Ionic Composition of River Water in the Plain of Alsace (Eastern France),
W86-03763 2F

CH2M HILL INTERNATIONAL CORP., GAINESVILLE, FL.
Continuous DO Response Predicted Using CSPSS Is Verified for Springfield, Missouri,
W86-03826 5B

CHATTANOOGA INTERCEPTOR SEWER SYSTEM, TN. MOCCASIN BEND TREATMENT PLANT.
City of Chattanooga Industrial-Municipal Pretreatment Program,
W86-03899 5D

CLEMSON UNIV., SC.
Hyperfiltration of Textile Process Water for Reuse,
W86-03535 5D

COAST GUARD ACADEMY, NEW LONDON, CT.
West Greenland Outlet Glaciers: An Inventory of the Major Iceberg Producers,
W86-03679 2C

COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, NH.
Pilot-Scale Evaluation of the Nutrient Film Technique for Wastewater Treatment,
W86-03515 5D

COLORADO STATE UNIV., FORT COLLINS.
Viability of Interbasin, Interstate/International Transfers of Water,
W86-03436 6D

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRICULTURAL AND CHEMICAL ENGINEERING.
Water Quality Monitoring: A System's Perspective,
W86-03655 7A

COLUMBIA NATIONAL FISHERIES RESEARCH LAB., LA CROSSE, WI. FIELD RESEARCH STATION.
Longitudinal Distribution of Trace Elements (As, Cd, Cr, Hg, Pb, and Se) in Fishes and Sediments in the Upper Mississippi River,
W86-03743 5B

Problems on the Upper Mississippi River and Its Tributaries: Need for a Long-Term Resource Monitoring Program,
W86-03751 7A

CONNECTICUT AGRICULTURAL EXPERIMENT STATION, NEW HAVEN.
Chemical and Physical Properties of Connecticut Lakes,
W86-03438 2H

COOK COLL., NEW BRUNSWICK, NJ. DEPT. OF ENVIRONMENTAL SCIENCE.
Extracellular Metabolite Involvement in Plankton Community Structure,
W86-03491 2H

COOPERATIVE INST. FOR RESEARCH IN ENVIRONMENTAL SCIENCE, BOULDER, CO.
Climatic Background to Some Glacier Fluctuations,
W86-03699 2C

CORPS OF ENGINEERS, BUFFALO, NY. BUFFALO DISTRICT.
Final Environmental Impact Statement: Regional Flood Control Tonawanda Creek, Genesee County, New York,
W86-03626 4A

DEARBORN ENVIRONMENTAL CONSULTING SERVICES, MISSISSAUGA (ONTARIO).
Water and Waste Management in the Canadian Meat and Poultry Processing Industry,
W86-03612 5E

Pilot-Scale Assessment of the Biological Fludized Bed Process for Municipal Wastewater Treatment,
W86-03631 5D

DELAWARE UNIV., NEWARK. DEPT. OF CIVIL ENGINEERING.
Functional Design of Activated Sludge Processes,
W86-03670 5D

DEPARTAMENTO DE RECURSOS NATURALES Y ENERGIA, SAN CARLOS DE BARILOCHE (ARGENTINA).
East-West and North-South Snow Line Gradients in the Northern Patagonian Andes, Argentina,
W86-03674 2C

DEPARTMENT OF HYDROLOGY AND METEOROLOGY, MASERU (LESOTHO).
Suspended Sediment Transport Measurement in Lesotho,
W86-03587 2J

DEPARTMENT OF LANDS, VALUATION AND WATER, LILONGWE (MALAWI).
Performance of Sanitary Completion Measures of Wells and Boreholes Used for Rural Water Supplies in Malawi,
W86-03582 5G

DEPARTMENT OF THE ENVIRONMENT, OTTAWA (ONTARIO).
Proceedings of the 6th Symposium on Wastewater Treatment,
W86-03659 5D

DIENST GRONDWATERVERKENNING TNO, DELFT (NETHERLANDS).
Water Resources Assessment Study in Kiambu District, Kenya,
W86-03571 2F

DOW CHEMICAL CO., MIDLAND, MI. ENVIRONMENTAL SCIENCES RESEARCH LAB.
Evaluative Model for Estimating Environmental Fate,
W86-03424 5B

DOW CHEMICAL U.S.A., FREEPORT, TX. TEXAS DIV.
Selection Criteria and Procedures for Establishing Mariculture Facilities in Existing Containment Sites,
W86-03712 5C

DOW CHEMICAL U.S.A., MIDLAND, MI.
Validation and Priority Pollutant Analysis,
W86-03792 5A

DU PONT DE NEMOURS (E.I.) AND CO., AIKEN, SC. SAVANNAH RIVER PLANT.
Report of Analyses for Light Hydrocarbons in Ground Water,
W86-03512 5A

DURBAN-WESTVILLE UNIV. (SOUTH AFRICA). DEPT. OF GEOGRAPHY.
Veld Burning and Sediment Yield from Small Drainage Basins,
W86-03588 4D

EIDGENOESSISCHE TECHNISCHE HOCHSCHULE, ZURICH (SWITZERLAND).
Present and Late Pleistocene Equilibrium Line Altitudes in the Mt Everest Region - An Application of the Glacier Inventory,
W86-03681 2C

Some Comments on the Swiss Glacier Inventory,
W86-03690 2C

Parameterization of Glacier Equilibrium Line Altitude,
W86-03696 2C

Effect of Topographic Orientation on the Variations of Glacier Length,
W86-03700 2C

View on Our Knowledge of Water Resources in Relation to Climate in the Alps,
W86-03847 2B

Regional Water Balance in the Mountainous Arctic and Its Application for Water-Resource Planning,
W86-03849 2D

EIDGENOESSISCHE TECHNISCHE HOCHSCHULE, ZURICH (SWITZERLAND). GEOGRAPHISCHES INST.
Applied Climatology.
W86-03846 2B

ELECTRONIC TECHNIQUES, INC., FORT COLLINS, CO.
SCPP Forecasting Support for the Period 1 December 1978 through 30 September 1984,
W86-03495 3B

EMA, INC., ST. PAUL, MN.
Computer as a Tool for Activated Sludge,
W86-03732 5D

ENERGY RESOURCE MANAGEMENT, TUCSON, AZ.
Instrumentation and Methods Evaluations for Shallow Land Burial of Waste Materials: Water Erosion,
W86-03510 5E

ENVIRONMENTAL MONITORING AND SUPPORT LAB., LAS VEGAS, NV. MONITORING OPERATIONS DIV.
Relationship of Common Dominant Phytoplankton to Water Temperature and Season,
W86-03724 2H

Relationship of Common Phytoplankton Genera to Nutrients in Eastern and Southeastern Lakes,
W86-03725 2H

ENVIRONMENTAL MONITORING SYSTEMS LAB., LAS VEGAS, NV.
Proceedings of Workshop on Algal Management and Control,
W86-03483 4A

Effect of Light Attenuation on the Relationship of Phytoplankton Biomass to Phosphorus Levels,
W86-03726 2H

ENVIRONMENTAL PROTECTION AGENCY, CINCINNATI, OH.
Quality Assurance for Water and Wastewater Analyses,
W86-03528 5A

ENVIRONMENTAL PROTECTION AGENCY, KANSAS CITY, MO. REGION VII.
Priority Pollutant Methodology Quality Assurance Review,
W86-03529 5A

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC.
Industrial Categorical Pretreatment Standards,
W86-03885 5D

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. OFFICE OF PESTICIDES AND TOXIC SUBSTANCES.
Role of Environmental Transport and Fate Models in Implementing the Toxic Substances Control Act,
W86-03420 5B

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. OFFICE OF WATER PLANNING AND STANDARDS.
Predictive Fate Models: Their Role in the U.S. Environmental Protection Agency's Water Program,
W86-03421 5B

ENVIRONMENTAL PROTECTION SERVICE, OTTAWA (ONTARIO).
Onshore Impacts of Offshore Hydrocarbon Development: Annotated Bibliography,
W86-03620 5C

Evaluation of Oil Skimmers and Pumps,
W86-03625 5G

Inventory of Canadian Glaciers: Procedures, Techniques, Progress and Applications,
W86-03677 2C

ENVIRONMENTAL PROTECTION SERVICE, OTTAWA (ONTARIO). WATER POLLUTION CONTROL DIRECTORATE.
Status Report on Compliance with the Chlor-Alkali Mercury Liquid Effluent Regulations 1978-79,
W86-03613 5D

Status Report on Compliance with the Chlor-Alkali Mercury Liquid Effluent Regulations 1980-81,
W86-03633 5E

ENVIRONMENTAL RESEARCH LAB., ATHENS, GA.
Identification and Evaluation of Fundamental Transport and Transformation Process Models,
W86-03422 5B

Master Analytical Scheme: An Overview of Interim Procedures,
W86-03793 5A

Evaluation of Trace Enrichment Methodology in Conjuction with Reverse-Phase High-Performance Liquid Chromatography for Preconcentration, Separation and Quantification of Trace Non-Volatile Organic Compounds in Aqueous Environmental Samples,
W86-03817 5A

High-Performance Liquid Chromatographic Determination of Nitrosamines in Water and Wastewater,
W86-03818 5A

Proceedings of Stormwater and Water Quality Management Modeling Users Group Meeting.
W86-03822 5B

ENVIRONMENTAL RESEARCH LAB.-DULUTH, GROSSE ILE, MI. LARGE LAKES RESEARCH STATION.
Phytoplankton-Nutrient Kinetics Mechanisms in Mathematical Simulation Models, with Special Attention to Reservoirs and Impoundments,
W86-03717 2H

Analysis of Polychlorinated Biphenyls by Glass Capillary and Packed-Column Chromatography,
W86-03802 5A

ENVIROSPHERE CO., BELLEVUE, WA.
Nitrogen Fixation and Phytoplankton Interactions in Southwestern Reservoirs,
W86-03720 2H

ERM-SOUTHEAST, INC., BRENTWOOD, TN.
Legal Validation of Environmental Fate Models,
W86-03434 5G

EXETER UNIV. (ENGLAND).
Sediment Yields of African Rivers,
W86-03584 2J

FISCHER AND PORTER, CO., WARMINSTER, PA.
Determination of Chlorine Dioxide,
W86-03541 5A

FISH AND WILDLIFE SERVICE, LAFAYETTE, LA.
Effects of Wetland Deterioration on the Fish and Wildlife Resources of Coastal Louisiana,
W86-03857 2L

FITCHBURG WASTEWATER TREATMENT FACILITIES, MA.
Full Scale Experience with Activated Carbon Treatment of Joint Municipal - Industrial Wastewater,
W86-03892 5D

FLORIDA INTERNATIONAL UNIV., MIAMI.
Pollution in Swimming Pool Water,
W86-03544 5B

FLORIDA UNIV., GAINESVILLE. DEPT. OF ENVIRONMENTAL ENGINEERING SCIENCES.
Algal Control through Trophic-Level Interactions: A Subtropical Persepctive,
W86-03490 5G

FLORIDA UNIV., GAINESVILLE. SCHOOL OF FOREST RESOURCES AND CONSERVATION.
Large-Scale Operations Management Test of Use of the White Amur for Control of Problem Aquatic Plants, Report 2: First Year Poststocking Results,
W86-03454 2H

FOREST SERVICE, OGDEN, UT. INTERMOUNTAIN REGION.
Streamflow Summaries from Twelve Tributaries of Farmington Creek, Davis County Experimental Watershed, Northern Utah,
W86-03640 2A

FOUNDATION TRUST LTD., SALZBURG (AUSTRIA).
Use of Aquatic Macrophytes for Sludge Treatment,
W86-03669 5D

GEOLOGICAL SURVEY, CHEYENNE, WY. WATER RESOURCES DIV.
Time of Travel and Dispersion of Solutes in a 36.4-Mile Reach of the North Platte River Downstream from Casper, Wyoming,
W86-03559 2E

GEOLOGICAL SURVEY, DORAVILLE, GA. WATER RESOURCES DIV.
Inland Travel of Tide-Driven Saline Water in the Altamaha and Satilla Rivers, Georgia, and the St. Marys River, Georgia-Florida,
W86-03561 2L

GEOLOGICAL SURVEY, HARRISBURG, PA. WATER RESOURCES DIV.
Hydrology of Area 1, Eastern Coal Province, Pennsylvania,
W86-03547 2E

GEOLOGICAL SURVEY, HELENA, MT. WATER RESOURCES DIV.
Geochemistry and Geohydrology of the West Decker and Big Sky Coal-Mining Areas, Southeastern Montana,
W86-03545 2K

GEOLOGICAL SURVEY, INDIANAPOLIS, IN. WATER RESOURCES DIV.
Floods of March 1982, Indiana, Michigan, and Ohio,
W86-03552 2E

GEOLOGICAL SURVEY, LAKEWOOD, CO. WATER RESOURCES DIV.
Water Resources Data, Colorado, Water Year 1981; Volume 3: Dolores River Basin, Green River Basin, and San Juan River Basin.
W86-03609 2E

GEOLOGICAL SURVEY, LANSING, MI. WATER RESOURCES DIV.
Hydrology and Land Use in Van Buren County, Michigan,
W86-03554 2E

GEOLOGICAL SURVEY, LITTLE ROCK, AR. WATER RESOURCES DIV.
Ground-Water Levels in Arkansas, Spring 1984,
W86-03553 2F

GEOLOGICAL SURVEY, MENLO PARK, CA.
Contaminants in the Upper Mississippi River: Summary and Conclusions,
W86-03752 6G

GEOLOGICAL SURVEY, MENLO PARK, CA. WATER RESOURCES DIV.
Results of a Solute Transport Experiment at Uvas Creek, September 1972,
W86-03556 2E

GEOLOGICAL SURVEY, NASHVILLE, TN. WATER RESOURCES DIV.
Ground Water in Carbonate Rocks and Regolith in the Fairview Area, Tennessee,
W86-03548 2F

Drought-Related Impacts on Municipal and Major Self-Supplied Industrial Water Withdrawals in Tennessee, (Part A and Part B),
W86-03560 6D

GEOLOGICAL SURVEY, NSTL STATION, MS. GULF COAST HYDROSCIENCE CENTER.
Evaluation of Selected One-Dimensional Stream Water-Quality Models with Field Data,
W86-03644 5B

GEOLOGICAL SURVEY, PORTLAND, OR. WATER RESOURCES DIV.
Statistical Summaries of Streamflow Data in Oregon; Volume 1 Eastern Oregon,
W86-03550 2E

GEOLOGICAL SURVEY, RAPID CITY, SD. WATER RESOURCES DIV.
Geologic and Hydrologic Data from a Test-Drilling Program in the High Plains Areas of South Dakota, 1979-1980,
W86-03558 2F

GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV.
Directory of Member Organizations of the National Water Data Exchange (NAWDEX),
W86-03557 10D

Satellite Image Atlas of Glaciers,
W86-03703 2C

GEOLOGICAL SURVEY, SYOSSET, NY. WATER RESOURCES DIV.
Streamflow Augmentation at Fosters Brook, Long Island, New York - A Hydraulic Feasibility Study,
W86-03551 4A

GEOLOGICAL SURVEY, TALLAHASSEE, FL. WATER RESOURCES DIV.
Evaluation of Future Base-Flow Water-Quality Conditions in the Hillsborough River, Florida,
W86-03546 5B

Chemical Quality of Landfill Leachate in Treatment Ponds and Migration of Leachate in the Surficial Aquifer, Pinellas County, Florida,
W86-03549 5B

Hydrogeologic Data from a Test Well at Kathryn Abbey Hanna Park, City of Jacksonville, Florida,
W86-03555 2F

GEOLOGICAL SURVEY, TOWSON, MD. WATER RESOURCES DIV.
Chemical and Microbiological Monitoring of a Sole-Source Aquifer Intended for Artificial Recharge, Nassau County, New York,
W86-03527 5A

GEORGIA UNIV., ATHENS. DEPT. OF ZOOLOGY.
Limits to the Control of Algal Populations by Grazing Zooplankton: The Environmental Theater and the Ecological Play,
W86-03489 5G

GEORGIA UNIV., ATHENS. INST. OF ECOLOGY.
Testing Models of the Fate of Chemicals in Aquatic Environments,
W86-03430 5B

GOETTINGEN UNIV. (GERMANY, F.R.).
Impact of Nitrogen Fertilizer Application on the Nitrate Concentration in Groundwater: Cost-Benefit Analysis Considerations,
W86-03652 5G

GORE AND STORRIE LTD., TORONTO (ONTARIO).
Slime Growth on Fine Bubble Diffusers,
W86-03672 5D

Preparing a Design Storm,
W86-03833 2A

GOSUDARSTVENNYI GIDROLOGICHESKII INST., LENINGRAD (USSR).
Study of Anthropogenic Influence on Water Quality in Some Rivers of the Baltic Sea Basin,
W86-03779 5B

GRANDE DIXENCE SOCIETE ANONYME, SION (SWITZERLAND).
Discharge Forecasting from Glacierized Areas to Optimize Hydroelectric Power Management,
W86-03848 8C

GROELANDS GEOLOGISKE UNDERSOEGELSE, COPENHAGEN (DENMARK).
Hydrological Basins in West Greenland and Their Relationship to a Preliminary Sectorial Division of the Inland Ice Sheet,
W86-03678 2C

GRW ENGINEERS, LEXINGTON, KY.
Joint Hydrogeological Surveys,
W86-03579 6E

GULF COAST RESEARCH LAB., OCEAN SPRINGS, MS. ANALYTICAL CHEMISTRY SECTION.
Pollutant Transport in Mississippi Sound: Interim Technical Report III,
W86-03839 5B

GULF SOUTH RESEARCH INST., NEW ORLEANS, LA.
Master Analytical Scheme: Development of Effective Techniques for Isolation and Concentration of Organics in Water,
W86-03794 5A

Master Analytical Scheme: An Assessment of Factors Influencing Precision and Accuracy of Gas Chromatography/Mass Spectrometry Data,
W86-03795 5A

HANOVER UNIV. (GERMANY, F.R.).
Glacier Inventory of Bolivia,
W86-03676 2C

HEWLETT-PACKARD CO., AVONDALE, PA. AVONDALE DIV.
Chromatographic Considerations for the Analysis of Acid-Extractable Priority Pollutants,
W86-03800 5A

HIGHER INST. OF MINING AND GEOLOGY, SOFIA (BULGARIA).
Model Experimental Study of Hydrochemical Processes in the Saturated Zone,
W86-03785 2K

HYDRAULICS RESEARCH STATION, WALLINGFORD (ENGLAND).
Measurement of Soil Loss from Experimental Basins in Malawi,
W86-03590 2J

Sediment Deposition in Major Reservoirs in the Zambezi Basin,
W86-03606 2J

Feasibility of Flushing Sediments through Reservoirs,
W86-03608 2J

HYDROCHEMICAL INST., ROSTOV-NA-DONU (USSR).
Study of the Hydrochemical Regime and Its Long-Term Variations in the Case of Some Rivers in U.S.S.R.,
W86-03778 2K

HYDROCOMP, INC., MOUNTAIN VIEW, CA.
Hydrologic Transport Modeling,
W86-03427 5B

HYDRONAUTICS, INC., LAUREL, MD.
Demonstration of a Cross-Flow Microfiltration System from the Removal of Toxic Heavy Metals from Battery Manufacturing Wastewater Effluents,
W86-03533 5D

HYDROQUAL, INC., MAHWAH, NJ.
Simplified Model of the Fate of Partitioning Chemicals in Lakes and Streams,
W86-03426 5B

ICI AMERICAS, INC., WILMINGTON, DE.
Use of Granular Activated Carbon to Treat Municipal Wastewater Receiving Industrial Flow,
W86-03891 5D

IFE UNIV. (NIGERIA). DEPT. OF GEOGRAPHY.
Groundwater Resources in Tropical African Regoliths,
W86-03564 2F

ILLINOIS DEPT. OF CONSERVATION, SPRINGFIELD.
Relationship Between Stream Recreational Use and Stream Characteristics with Implications for Management of Illinois Streams,
W86-03451 5G

Induced Change and Its Impact on Aquatic Community Quality in the Sangamon River Basin of Illinois,
W86-03453 5G

ILLINOIS DEPT. OF CONSERVATION, SPRINGFIELD. COMPREHENSIVE PLANNING SECTION.
Planning Approach for Improved Management of Illinois Streams for Recreation and Conservation,
W86-03452 5G

ILLINOIS NATURAL HISTORY SURVEY, CHAMPAIGN.
Role of Contaminants in the Decline of the Illinois River: Implications for the Upper Mississippi,
W86-03739 6G

ILLINOIS STATE ENVIRONMENTAL PROTECTION AGENCY, SPRINGFIELD. DIV. OF WATER POLLUTION CONTROL.
Water Resource Data and Trend Analysis for the Blue Creek Watershed Project, Pike County, Illinois: Phase II,
W86-03610 5G

ILLINOIS STATE WATER SURVEY DIV., CHAMPAIGN.
Evaluating the Use of Depth-Frequency Equations for Enforcing Local Floodplain Regulations,
W86-03450 2E

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF CIVIL ENGINEERING.
Nonlinear Programming Model of a Wastewater Treatment System: Sensitivity Analysis and a Robustness Constraint,
W86-03511 5D

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. INST. FOR ENVIRONMENTAL STUDIES.
Effect of Soil on the Mutagenic Properties of Waste Water,
W86-03502 5C

ILORIN UNIV. (NIGERIA). DEPT. OF GEOLOGY.
Electric Logs for Groundwater Exploration in the Niger Delta.
W86-03570 2F

INDUSTRIAL ENVIRONMENTAL RESEARCH LAB.-CINCINNATI, OH.
Quality Assurance in the Evaluation of Pollution Control Technology: Experiences at the Industrial Environmental Research Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio,
W86-03530 5A

INSTITUTE FOR SOIL FERTILITY, GRONINGEN (NETHERLANDS).
Accumulation and Transport of Water and Solutes in the Saturated and Unsaturated Zones,
W86-03784 2F

INSTITUTE OF AGRICULTURAL ENGINEERING, HARARE (ZIMBABWE).
Sheet Erosion from Arable Lands in Zimbabwe: Prediction and Control,
W86-03596 2J

INSTITUTE OF HYDROLOGY, WALLINGFORD (ENGLAND).
Low Cost Hydrological Data Collection,
W86-03581 7B

INSTITUTO ARGENTINO DE NIVOLOGIA Y GLACIOLOGIA, MENDOZA.
Glaciers and Glaciolithic Systems of the Central Andes,
W86-03675 2C

INSTITUUT VOOR CULTUURTECHNIEK EN WATERHUISHOUDING, WAGENINGEN (NETHERLANDS).
Effects of Regional Water Management on N-Pollution in Areas with Intensive Agriculture,
W86-03650 5G

INTERA TECHNOLOGIES, INC., HOUSTON, TX.
Consequence Assessment of Hydrological Communications through Borehole Plugs,
W86-03629 5G

INTERNATIONAL ENVIRONMENTAL CONSULTANTS LTD., ISLINGTON (ONTARIO).
Evaluation of Biological Nitrification-Denitrification at Penticton, British Columbia,
W86-03619 5D

INTERNATIONAL INST. FOR APPLIED SYSTEMS ANALYSIS, LAXENBURG (AUSTRIA).
Nonpoint Nitrate Pollution of Municipal Water Supply Sources: Issues of Analysis and Control,
W86-03649 5G

INTERNATIONAL INST. OF TROPICAL AGRICULTURE, IBADAN (NIGERIA).
Testing the Applicability of a Soil Erodibility Nomogram for Some Tropical Soils,
W86-03599 2J

Mulch Requirements for Erosion Control with the No-Till System in the Tropics: A Review,
W86-03600 4D

IOWA UNIV., IOWA CITY. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Fate and Transport Modeling for Toxic Substances,
W86-03425 5B

ISTANBUL UNIV. (TURKEY).
Present Glaciation in Turkey,
W86-03689 2C

JACOBS ENGINEERING GROUP, INC., WASHINGTON, DC.
Review of the Use of Ozone for Improving Combined Municipal/Industrial Wastewater Treatment,
W86-03894 5D

JAPAN BOTTOM SEDIMENT MANAGEMENT ASSOCIATION, TOKYO.
Theoretical Considerations of Gravity Dewatering of Dredged Material Through the Bottom of a Containment Area,
W86-03870 5D

Rapid Dewatering Test of Dredged Material In Situ,
W86-03871 5D

Theoretical Consideration of Pond and Spillwater Treatment Design,
W86-03876 5G

Measurement of Nutrient Concentrations in Sediment Pore Water Collected by a Dialysis Sampler,
W86-03877 5A

JAPAN DREDGING AND RECLAMATION ENGINEERING ASSOCIATION, TOKYO.
Dispersion of Sediment Resuspension Caused by Dredge Operation,
W86-03873 5B

JAPAN WORKVESSEL ASSOCIATION, TOKYO.
New Techniques Developed in Japan for Oil Spill Cleanup,
W86-03875 5B

JOHNS HOPKINS UNIV., BALTIMORE, MD. SCHOOL OF HYGIENE AND PUBLIC HEALTH.
Biological Evaluation of Methods for the Determination of Free Available Chlorine,
W86-03539 5A

KENT STATE UNIV., OH. DEPT. OF BIOLOGICAL SCIENCES.
State-of-the-Art Summary of Phosphorus Inactivation as a Lake Restoration Technique,
W86-03486 5G

KIEL UNIV. (GERMANY, F.R.).
Role of Natural Organics on Water Interaction with Soil and Rock,
W86-03754 2K

Interaction Water-Silicate Minerals in the Unsaturated Zone Controlled by Thermodynamic Disequilibria,
W86-03756 2K

LABORATOIRE DE GLACIOLOGIE ET GEOPHYSIQUE DE L'ENVIRONNEMENT, GRENOBLE (FRANCE).
Can the Linear Balance Model Be Extended to the Whole Alps,
W86-03697 2C

LAMONT-DOHERTY GEOLOGICAL OBSERVATORY, PALISADES, NY.
Recent Secular Variations of Snow and Sea Ice Cover,
W86-03695 2C

LAVAL UNIV., QUEBEC.
Introduction to Wastewater Treatment Processes,
W86-03455 5D

LIFE SYSTEMS, INC., CLEVELAND, OH.
Development of a TOC/COD Analyzer for Process Applications,
W86-03526 5A

LINCOLN COLL. (NEW ZEALAND). TUSSOCK GRASSLANDS AND MOUNTAIN LANDS INST.
Present and Potential Use of Micro-Hydro-Electric Schemes in Remote Locations,
W86-03505 8A

LITTLE (ARTHUR D.), INC., CAMBRIDGE, MA.
Groundwater Contamination and Emergency Response Guide,
W86-03457 5G

Evaluation of the Microextraction Technique to Analyze Organics in Water,
W86-03807 5A

LOCKHEED ENGINEERING AND MANAGEMENT SERVICES CO., INC., HOUSTON, TX.
Comparison of Soil Moisture Characteristics Predicted by the Arya-Paris Model with Laboratory-Measured Data,
W86-03636 2G

LOS ALAMOS NATIONAL LAB., NM.
Transport of Contaminants from Energy Process Waste Leachates through Subsurface Soils and Soil Components Laboratory Experiments,
W86-03500 5B

LOUGHBOROUGH UNIV. OF TECHNOLOGY (ENGLAND). DEPT. OF GEOGRAPHY.
Impounded Rivers: Perspectives for Ecological Management,
W86-03516 6G

LOUISIANA DEPT. OF WILDLIFE AND FISHERIES, BATON ROUGE.
Some Consequences of Wetland Modification to Louisiana's Fisheries,
W86-03858 2L

LOUISIANA GEOLOGICAL SURVEY, BATON ROUGE.
Assessment of Geological and Human Factors Responsible for Louisiana Coastal Barrier Erosion,
W86-03852 2J

LOUISIANA STATE UNIV., BATON ROUGE. CENTER FOR WETLAND RESOURCES.
Literature Survey of Reservoir Contaminant Problems,
W86-03623 5B

Sedimentation and Apparent Sea-Level Rise as Factors Affecting Land Loss in Coastal Louisiana,
W86-03851 2J

Wetland Loss Directly Associated with Canal Dredging in the Louisiana Coastal Zone,
W86-03854 6G

Canals and Wetland Erosion Rates in Coastal Louisiana,
W86-03855 6G

Wetland Losses and Coastal Fisheries: An Enigmatic and Economically Significant Dependency,
W86-03859 2L

Sand Dune Vegetation and Stabilization in Louisiana,
W86-03864 2J

Comparison of Effectiveness of Management Options for Wetland Loss in the Coastal Zone of Louisiana,
W86-03866 2L

LOUISIANA STATE UNIV., BATON ROUGE. COASTAL STUDIES INST.
Mudflat and Marsh Progradation Along Louisiana's Chenier Plain: A Natural Reversal in Coastal Erosion,
W86-03853 2J

Reversal of Coastal Erosion by Rapid Sedimentation: The Atchafalaya Delta (South-Central Louisiana),
W86-03865 2J

LOUISIANA STATE UNIV., BATON ROUGE. DEPT. OF GEOLOGY.
Future Sea Level Changes Along the Louisiana Coast,
W86-03862 2L

LOUISIANA STATE UNIV., BATON ROUGE. SCHOOL OF FORESTRY AND WILDLIFE MANAGEMENT.
Effect of Coastal Alteration on Marsh Plants,
W86-03856 2L

LOUISIANA STATE UNIV., BATON ROUGE. SEA GRANT LEGAL PROGRAM.
Legal Implications of Coastal Erosion in Louisiana,
W86-03860 6E

LOUISIANA UNIVERSITIES MARINE CONSORTIUM, CHAUVIN.
Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options.
W86-03850 2J

MAIDUGURI UNIV. (NIGERIA). DEPT. OF AGRICULTURAL ENGINEERING.
Artificial Recharge of Groundwater Resources in Semiarid Regions,
W86-03572 4B

MARYLAND-NATIONAL CAPITAL PARK AND PLANNING COMMISSION, UPPER MARLBORO.
Separation of Boundary Layer and Flow Turbulence of Center-Feed Circular Sedimentation Basins,
W86-03830 5D

MCMASTER UNIV., HAMILTON (ONTARIO).
Atmospheric Pollution in Relation to Storm Water Quality Modelling: Literature Review for an Industrial City,
W86-03838 5B

MCMASTER UNIV., HAMILTON (ONTARIO). DEPT. OF CIVIL ENGINEERING AND ENGINEERING MECHANICS.
Hydrometeorological Data Acquisition: Innovative, High-Resolution Programmable Instrumentation for Stormwater Management,
W86-03829 7B

MEDICAL COLL. OF OHIO AT TOLEDO. DEPT. OF MICROBIOLOGY.
Utilization of Bacteria in Managing Cyanobacterial Populations: A Review and Update,
W86-03493 2H

METCALF AND EDDY, INC., SAN BERNARDINO, CA.
Land Treatment of Combined Municipal/Industrial Wastewaters,
W86-03896 5D

METCALF AND EDDY, INC., WAKEFIELD, MA.
Biological Inhibition Screening of Industrial Wastewaters,
W86-03888 5D

METROPOLITAN WASTE CONTROL COMMISSION, ST. PAUL, MN.
Trace Elements in the Water, Sediments, and Fish of the Upper Mississippi River, Twin Cities Metropolitan Area,
W86-03745 5B

MICHIGAN DEPT. OF NATURAL RESOURCES, LANSING. WATER QUALITY DIV.
Groundwater Management Strategy for Michigan: Public Notification Methods.
W86-03513 5G

MICHIGAN STATE UNIV., EAST LANSING.
Assessment of Transport and Fate of Toxic Materials in an Experimental Stream Ecosystem,
W86-03433 5B

MICHIGAN STATE UNIV., HICKORY CORNERS. W.K. KELLOGG BIOLOGICAL STATION.
Dissolved Organic Matter and Lake Metabolism: Biogeochemistry and Controls of Nutrient Flux Dynamics in Lakes,
W86-03504 2H

MIDWEST RESEARCH INST., KANSAS CITY, MO.
Development of Methods for Pesticides in Wastewater: Applicability of a General Approach,
W86-03798 5A

MINERALS MANAGEMENT SERVICE, METAIRIE, LA. GULF OF MEXICO OCS REGIONAL OFFICE.
Proceedings: 2nd Annual Gulf of Mexico Information Transfer Meeting.
W86-03841 10D

MINERALS MANAGEMENT SERVICE, RESTON, VA.
Anti-Turbidity Overflow System (ATOS) Used for Reducing the Dispersion of Fine Sediments from a Dredge Plane,
W86-03874 5E

MINISTRY OF AGRICULTURE, JERUSALEM (ISRAEL). HYDROLOGICAL SERVICE.
Design of a Hydrochemical Data Collection Programme,
W86-03767 7A

Hydrochemical Relationships Between Rainwater, Floods, Groundwater and Lithology in the Avedat Group on the Negev Highlands, Israel,
W86-03789 2A

MINISTRY OF WATER DEVELOPMENT, SALISBURY (ZIMBABWE).
Challenges in African Hydrology and Water Resources: Proceedings of the Harare Symposium,
W86-03562 2F

MINISTRY OF WATER RESOURCES AND DEVELOPMENT, HARARE (ZIMBABWE).
Sediment Storage Requirements for Reservoirs,
W86-03607 2J

MINISTRY OF WORKS AND DEVELOPMENT, CHRISTCHURCH (NEW ZEALAND).
Glacier Snow Line Variations in the Southern Alps, New Zealand,
W86-03692 2C

Glacier Balances in the Dry Valleys Area, Victoria Land, Antarctica,
W86-03694 2C

MINNESOTA POLLUTION CONTROL AGENCY, ROSEVILLE.
Polychlorinated Biphenyls (PCBs) in Common Carp (Cyprinus carpio) of the Upper Mississippi River,
W86-03746 5B

Establishment of an Ammonia Effluent Limitation for the Twin Cities Metro Plant,
W86-03748 5B

MINNESOTA UNIV., MINNEAPOLIS.
Ultraviolet Multiwavelength Absorbance Measurements for Monitoring Trace Organics in Water,
W86-03525 5A

MINNESOTA UNIV., MINNEAPOLIS. DEPT. OF CHEMISTRY.
Determination of Carbohydrates and Primary Amines in River Water,
W86-03524 5A

MINNESOTA UNIV., NAVARRE. GRAY FRESHWATER BIOLOGICAL INST.
Detection and Quantification of Electrophiles in Environmental Samples: Labeling of Potential Mutagens in Drinking Water by 4-Nitrothiophenol,
W86-03820 5A

MISSOURI UNIV.-ROLLA. INST. OF RIVER STUDIES.
Influence of Channel Regulating Structures on Fish and Wildlife Habitat: Appendix - Volume I, Figures and Photographs.
W86-03509 6G

MMM DESIGN GROUP, NORFOLK, VA.
Chimney Hill Off-Site Drainage Study,
W86-03835 2A

MONTANA DEPT. OF NATURAL RESOURCES AND CONSERVATION, HELENA.
1981 CCOPE PROBE Mesonet Calibration and Maintenance Procedures,
W86-03481 7B

MONTANA UNIV., MISSOULA.
Review of Control Measures for Objectional Algal 'Blooms',
W86-03484 5G

Algicides and Algal Management and Control: Bibliography,
W86-03494 5G

MONTGOMERY (JAMES M.), INC., PASADENA, CA.
Part-per-Trillion Analysis of Volatile, Base/Neutral and Acidic Water Contaminants on a Single Fused-Silica Capillary Column,
W86-03801 5A

MUNICIPAL ENVIRONMENTAL RESEARCH LAB.-CINCINNATI, EDISON, NJ. SOLID AND HAZARDOUS WASTE RESEARCH DIV.
Emergency Response Equipment to Clean Up Hazardous Chemical Releases at Spills and Uncontrolled Waste Sites,
W86-03476 5G

MUNICIPAL ENVIRONMENTAL RESEARCH LAB., CINCINNATI, OH. WASTEWATER RESEARCH DIV.
Implementation of Sequencing Batch Reactors for Municipal Wastewater Treatment,
W86-03664 5D

NAGOYA UNIV. (JAPAN). WATER RESEARCH INST.
Glacier Inventory in the Dudh Kosi Region, East Nepal,
W86-03682 2C

NAIROBI UNIV. (KENYA). DEPT. OF DENTAL SURGERY.
Occurrence and Distribution of Fluoride in Groundwaters of Kenya,
W86-03569 2K

NAIROBI UNIV. (KENYA). DEPT. OF GEOLOGY.
Some Implication of the Role of Kinetics in Enhancing Element Transport,
W86-03760 2K

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GREENBELT, MD. GODDARD SPACE FLIGHT CENTER.
Multi-Parameter Remote Measurement of Rainfall,
W86-03618 2B

NATIONAL ASSOCIATION OF CONSERVATION DISTRICTS, WASHINGTON, DC.
Sludge and the Land: The Role of Soil and Water Conservation Districts in Land Application of Sewage Sludge.
W86-03514 5E

NATIONAL BOARD OF WATERS, HELSINKI (FINLAND). WATER RESEARCH INST.
Publications of the Water Research Institute, 58.
W86-03842 5D

NATIONAL BUREAU OF STANDARDS (NML), GAITHERSBURG, MD.
Developments in the Analysis of Priority Pollutants by Liquid Chromatography/Mass Spectrometry and Immunoassay Procedures,
W86-03819 5A

NATIONAL COUNCIL OF THE PAPER INDUSTRY FOR AIR AND STREAM IMPROVEMENT, INC., MEDFORD, MA.
Study of the Selection, Calibration and Verification of Mathematical Water Quality Models,
W86-03823 5B

Assessment of the Measurement Uncertainty in the Estimation of Stream Reaeration Rate Coefficients Using Direct Tracer Techniques,
W86-03824 5A

NATIONAL FISHERY RESEARCH LAB., LA CROSSE, WI.
Water Chemistry at Selected Sites on Pools 7 and 8 of the Upper Mississippi River: A Ten-Year Survey,
W86-03749 5B

NATIONAL INST. FOR ENVIRONMENTAL STUDIES, TSUKUBA (JAPAN).
Separation of Runoff Components by NO3-N Loading and Estimation of Runoff Loading by Each Component,
W86-03788 5B

Hypolimnetic Oxygen Deficit in a Eutrophic Lake and the Role of Sediment Oxygen Demand,
W86-03869 5C

NATIONAL INST. FOR WATER RESEARCH, PRETORIA (SOUTH AFRICA).
Control and Measurement of Organic Micropollutants in South African Water Reclamation Plants,
W86-03522 5A

Role of Bottom Sediments in Modifying Soluble Phosphate Loads to a Dendritic, Hypertrophic Reservoir,
W86-03787 2J

Treatment of Combined Industrial and Domestic Wastewater for Reuse in South Africa,
W86-03890 5D

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, ANN ARBOR, MI. GREAT LAKES ENVIRONMENTAL RESEARCH LAB.
Use and Interpretation of Detailed, Mechanistic Models of Phytoplankton Dynamics,
W86-03719 2H

NATIONAL RESEARCH COUNCIL, WASHINGTON, DC. COMMITTEE ON A LEVEE POLICY FOR THE NATIONAL FLOOD INSURANCE PROGRAM.
Levee Policy for the National Flood Insurance Program,
W86-03622 6F

NATIONAL SUGAR RESEARCH STATION, KISUMU (KENYA).
Estimating Groundwater Recharge Based on Infiltration Characteristics of Layered Soil,
W86-03566 2F

NATIONAL WEATHER SERVICE, SILVER SPRING, MD. OFFICE OF HYDROLOGY.
Probable Maximum Precipitation Estimates for the Drainage Above Dewey Dam, Johns Creek, Kentucky,
W86-03503 2B

NATURVETENSKAPLIGA FORSKNINGSLABORATORIET I STUDSVIK, NYKOEPING (SWEDEN).
Hydrochemical Balances of Freshwater Systems: Proceedings of the Uppsala Symposium.
W86-03753 5B

NEBRASKA UNIV. AT OMAHA. REMOTE SENSING APPLICATIONS LAB.
Use of Landsat Digital Information for Assessing Glacier Inventory Parameters,
W86-03702 2C

NEW CASTLE COUNTY WATER RESOURCES AGENCY, DE.
Water 2000, Volume IX: Plan Management Summary,
W86-03435 6A

WATER 2000, Volume V: Water Supply Facility Optimization in Northern New Castle County.
W86-03443 5F

WATER 2000, Volume VI: Forecast of Future Water Demand in New Castle County.
W86-03444 6D

WATER 2000: Conservation Program.
W86-03445 3D

NICHOLLS STATE UNIV., THIBODAUX, LA. DEPT. OF EARTH SCIENCE.
Economic and Cultural Consequences of Land Loss in Louisiana,
W86-03861 6G

NORSK INST. FOR VANNFORSKNING, OSLO.
Determination of Polycyclic Aromatic Hydrocarbons in Industrial Discharges and Other Aqueous Effluents,
W86-03506 5A

Alkalinity Feed Forward Control of Alum Addition in Wastewater Treatment,
W86-03666 5D

NORTH TEXAS STATE UNIV., DENTON.
Analysis of Chlorinated Organic Compounds Formed During Chlorination of Wastewater Products,
W86-03496 5A

NORTH TEXAS STATE UNIV., DENTON. DEPT. OF CHEMISTRY.
Further Optimization of the Pentane Liquid-Liquid Extraction Method for the Analysis of Trace Organic Compounds in Water,
W86-03808 5A

Size Exclusion, Reverse-Phase and Weak Anion Exchange Chromatography of National Organics in Water,
W86-03815 5A

NORTHERN VIRGINIA PLANNING DISTRICT COMMISSION, ANNANDALE.
Hydrologic Modeling for Studies of Pollutant Loadings and Transport in Large River Basins,
W86-03827 5A

Use of Continuous Simulation Model Calibration Techniques to Develop Nonpoint Pollution Loading Factors,
W86-03828 5B

OAK RIDGE NATIONAL LAB., TN.
Evaluating Changes in Dike Field Fishes with Community Information Indices,
W86-03628 7A

OAK RIDGE NATIONAL LAB., TN. ANALYTICAL CHEMISTRY DIV.
Comparison of Several Methods for Collection and Quantification of Polycyclic Aromatic Hydrocarbons from Aqueous Media,
W86-03812 5A

OAK RIDGE NATIONAL LAB., TN. ENVIRONMENTAL SCIENCES DIV.
Evaluation of Community Information Indices for Mississippi River Fisheries,
W86-03499 7C

OFFICE DE LA RECHERCHE SCIENTIFIQUE ET TECHNIQUE OUTRE-MER, ABIDJAN (IVORY COAST).
Evaluation of Factors Influencing Water Erosion in West Africa Using Rainfall Simulation,
W86-03598 2J

OFFICE DE LA RECHERCHE SCIENTIFIQUE ET TECHNIQUE OUTRE-MER, PARIS (FRANCE).
Runoff, Erosion and Soil Fertility Restoration on the Mossi Plateau (Central Upper Volta),
W86-03601 4D

OKLAHOMA STATE UNIV., STILLWATER. SCHOOL OF CIVIL ENGINEERING.
Treatment of Municipal Wastewaters Containing Biologically Hazardous Industrial Compounds by Conventional Activated Sludge and Extended Aeration,
W86-03889 5D

OKLAHOMA UNIV., KINGSTON. BIOLOGICAL STATION.
DCMU-Enhanced Chlorophyll Fluorescence as an Indication of the Physiological Status of Reservoir Phytoplankton: An Initial Evaluation,
W86-03721 2H

OPERATING CONSULTANT SERVICES, CINCINNATI, OH.
Understanding the Application of Analytical Data to Process Control,
W86-03730 5D

OREGON STATE UNIV., CORVALLIS. DEPT. OF CHEMISTRY.
Stable Activable Tracers for Environmentally Significant Organic Molecules,
W86-03805 5A

OSAKA PORT AND HARBOUR BUREAU (JAPAN).
Removal of Bottom Sediments in Osaka Port by the Pneuma Pump Dredge 'Shunkai',
W86-03463 5G

OSLO UNIV. (NORWAY). DEPT. OF CHEMISTRY.
Use of Different Physical Separation Techniques for Trace Element Speciation Studies in Natural Waters,
W86-03771 2K

OSLO UNIV. (NORWAY). INST. OF GEOPHYSICS.
Data Collection for Hydrochemical Balances: Theoretical Aspects,
W86-03766 2A

OTTAWA UNIV. (ONTARIO). DEPT. OF GEOGRAPHY.
Rock Glaciers: Glacial and Non-Glacial Origins,
W86-03698 2C

P-III ASSOCIATES, INC., SALT LAKE CITY, UT.
Dirty Devil Project: Class II Cultral Resources Inventory in Central Utah,
W86-03518 6G

POLISH ACADEMY OF SCIENCES, WARSAW. GEOLOGICAL SCIENCES INST.
Hydrochemical Budgeting in Studies of Ground-Water Renewability in Areas of Glacial Formation Systems,
W86-03783 2F

POLYSAR LTD., SARNIA (ONTARIO).
Polysar Biological Oxidation Treatment Plant,
W86-03660 5D

Good Process Control: Planning and Implementation,
W86-03735 5D

PORTSMOUTH POLYTECHNIC (ENGLAND). DEPT. OF CIVIL ENGINEERING.
Potential of Reverse Osmosis for Recycling and Reuse of Sewage Effluents,
W86-03537 5D

PRAKLA-SEISMOS GEOMECHANIK, ACCRA (GHANA).
Some Critical Issues with Monitoring Crystalline Rock Aquifers for Groundwater Management in Rural Areas,
W86-03567 2F

PROCTER AND GAMBLE CO., CINCINNATI, OH.
Field Validation of Exposure Analysis Modeling System (EXAMS) in a Flowing Stream,
W86-03432 5B

Determination of Linear Alcohol Ethoxylates in Wastewater and Surface Water,
W86-03821 5A

PROCTOR AND REDFERN LTD., OTTAWA (ONTARIO).
Continuous Simulation of Instream Fecal Coliform Bacteria,
W86-03837 5B

PURDUE UNIV., LAFAYETTE, IN. DEPT. OF AGRONOMY.
Utilization of Sewage Sludges on Cropland,
W86-03897 5E

RAND AFRIKAANS UNIV., JOHANNESBURG (SOUTH AFRICA). DEPT. OF CIVIL ENGINEERING.
Predicting the Distribution of Depostied Sediment in Southern African Reservoirs,
W86-03605 2J

READING UNIV. (ENGLAND). DEPT. OF GEOGRAPHY.
Remote Sensing Applications in African Erosion and Sedimentation Studies,
W86-03592 7B

Indigenous Soil Conservation Studies in Sierra Leone,
W86-03603 4D

RENSSELAER POLYTECHNIC INST., TROY, NY.
Modeling Combined Effects of Environmental Factors on Phytoplankton,
W86-03718 2H

RENSSELAER POLYTECHNIC INST., TROY, NY. DEPT. OF CHEMICAL AND ENVIRONMENTAL ENGINEERING.
Rational Approaches in the Analysis of Chemical Disinfection Kinetics,
W86-03538 5D

RESEARCH TRIANGLE INST., RESEARCH TRIANGLE PARK, NC. ANALYTICAL SCIENCES DIV.
Quantitative Aspects of the Master Analytical Scheme for Organics in Water,
W86-03796 5A

Quality of Master Analytical Scheme Data: Purgeables and Volatile Organic Acids,
W86-03797 5A

High-Resolution Gas Chromatography and Negative Ion Chemical Ionization Mass Spectrometry of Polychlorinated Biphenyls,
W86-03803 5A

REXNORD, INC., MILWAUKEE, WI.
Mechanical Dewatering of Dredged Slurries,
W86-03872 5D

REXNORD, INC., MILWAUKEE, WI. ENVIRONMENTAL RESEARCH CENTER.
Characteristics and Treatability of Urban Runoff Residuals,
W86-03508 5B

RHODES UNIV., GRAHAMSTOWN (SOUTH AFRICA). DEPT. OF GEOGRAPHY.
Continuous Monitoring of Rainfall, Streamflow and Suspended Sediment Concentration in Semi-arid Environments,
W86-03591 7B

RICE UNIV., HOUSTON, TX. DEPT. OF ENVIRONMENTAL SCIENCE AND ENGINEERING.
Modeling Chemical Reactions and Transport in Groundwater Systems: A Review,
W86-03428 5B

ROBERT S. KERR ENVIRONMENTAL RESEARCH LAB., ADA, OK.
Proceedings of the Conference on Combined Municipal/Industrial Wastewater Treatment.
W86-03883 5D

ROCKWELL INTERNATIONAL, RICHLAND, WA. ENERGY SYSTEMS GROUP.
Hydrochemical and Isotopic Content of Basalt Groundwaters Beneath the Hanford Site, Washington,
W86-03517 2K

RUPKE AND ASSOCIATES LTD., BRADFORD (ONTARIO).
Pollution Control: The Hidden Profit Centre,
W86-03671 5D

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, NJ. CENTER FOR COASTAL AND ENVIRONMENTAL STUDIES.
Ecological Solutions to Environmental Management Concerns in the Pinelands National Reserve: Proceedins of a Conference,
W86-03616 2L

S-CUBED, LA JOLLA, CA.
Determination of Priority Pollutants in Industrial Wastewaters by Stable-Isotope Dilution Gas Chromatography/Mass Spectrometry,
W86-03804 5A

SAINT MARY'S COLL., WINONA, MN.
Polychlorinated Biphenyls and Organochlorine Insecticides in Great Blue Heron and Great Egret Eggs from the Upper Mississippi River,
W86-03747 5B

SAINT MARY'S COLL., WINONA, MN. DEPT. OF BIOLOGY.
Heavy Metal Accumulation in Selected Sessile Components of Fountain City Bay, Pool 5A, of the Upper Mississippi River,
W86-03744 5B

SAINT REGIS PAPER CO., SARTELL, MN.
Startup Critique of Sartell 3,
W86-03736 5D

SAVANNAH RIVER ECOLOGY LAB., AIKEN, SC.
Anomalous Breakthrough of Benzo(A)Pyrene during Concentration with Amberlite XAD-4 Resin from Aqueous Solutions,
W86-03813 5A

SCHMIDTKE (NORBERT W.) AND ASSOCIATES LTD., KITCHENER (ONTARIO).
Application of Biological Batch Reactor Technology in Wastewater Treatment,
W86-03665 5D

SHERBROOKE UNIV. (QUEBEC).
Relating BOD5 with On-Line Oxygen Uptake Rate Measurements Using Automatic Respirometers in View of Process Monitoring and Control,
W86-03733 5D

SIMONS, LI AND ASSOCIATES, INC., FORT COLLINS, CO.
Investigation of Effects of Navigation Traffic Activities on Hydrologic, Hydraulic, and Geomorphic Characteristics in the Upper Mississippi River System,
W86-03750 5B

SLOVENSKA AKADEMIA VIED, BRATISLAVA (CZECHOSLOVAKIA).
Aerobic Transformation of Nitrogenous Substances in a Freshwater Ecosystem,
W86-03782 5C

SMOKEY STACK, INC., CEDARS, PA.
Design of Activated Sludge Facilities for Operating and Maintainability,
W86-03734 5D

SOIL CONSERVATION SERVICE, WASHINGTON, DC.
Design Criteria for Aquaculture Ponds on Dredged Material,
W86-03713 8I

SOUTH CAROLINA UNIV., COLUMBIA. BELLE W. BARUCH INST. FOR MARINE BIOLOGY AND COASTAL RESEARCH.
Mariculture in Old Rice Field Impoundments: An Analogy for Dredged Material Containment Areas,
W86-03711 2L

SOUTHERN RESEARCH INST., BIRMINGHAM, AL.
Preparation of Ion-Exchange Membranes with Extremely Low Areal Resistances,
W86-03615 3A

Development of Ethanol-Selective Membranes,
W86-03617 5D

SOUTHWEST RESEARCH INST., SAN ANTONIO, TX.
Microextraction as an Approach to Analysis for Priority Pollutants in Industrial Wastewater,
W86-03806 5A

STANFORD UNIV., CA. DEPT. OF CIVIL ENGINEERING.
Chlorine Dioxide Chemistry: Generation and Residual Analysis,
W86-03540 5F

STATE UNIV. OF NEW YORK AT BINGHAMTON.
Insoluble Polymeric Contact Disinfectants: An Alternative Approach to Water Disinfection,
W86-03543 5F

STEFFEN, ROBERTSON AND KIRSTEN, INC., JOHANNESBURG (SOUTH AFRICA).
Sediment Yield Estimation and the Design of Sediment Control Structures in Rural Africa,
W86-03595 4D

Surface Erosion and Sediment Control at Open-Cast Mines in Southern Africa,
W86-03602 4D

SVERIGES GEOLOGISKA UNDERSOEKNING, UPPSALA.
Studies on Groundwater Transport in Fractured Crystalline Rock under Controlled Conditions Using Nonradioactive Tracers,
W86-03497 2F

SWEDISH ENVIRONMENTAL RESEARCH INST., STOCKHOLM.
Erosion of Agricultural Land - A Growing Water Quality Problem in Rural Areas,
W86-03780 5B

SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION, INC., WASHINGTON, DC.
Minimizing Costs by Good Financial Management,
W86-03886 6C

TAHAL-WATER PLANNING FOR ISRAEL LTD., TEL-AVIV.
Gross Organics Measurements for Monitoring of Wastewater Treatment and Reuse,
W86-03523 5A

TENECH ENVIRONMENTAL ENGINEERS, INC., LOUISVILLE, KY.
Final Environmental Impact Statement for Sludge Disposal for the Des Moines Integrated Community Area,
W86-03635 5E

TENNESSEE VALLEY AUTHORITY, CHATTANOOGA. DIV. OF WATER RESOURCES.
Phytoplankton Effects of Reservoir Use,
W86-03722 5G

TETRA TECH, INC., BELLEVUE, WA.
Aeration/Circulation for Control of Algal Production,
W86-03487 2G

TEXAS A AND M UNIV., COLLEGE STATION.
Health and Disease Control for Aquatic Animals in Dredged Material Containment Sites,
W86-03709 5C

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF WILDLIFE AND FISHERIES SCIENCES.
Review of Species Suitable for Containment Site Culture (Fresh Water),
W86-03706 2H

Pond Management: Polyculture vs. Monoculture,
W86-03707 2H

TEXAS DEPT. OF WATER RESOURCES, AUSTIN.
Ground-Water Conditions of the Triassic Aquifer in Deaf Smith and Swisher Counties,
W86-03439 2F

TEXAS DEPT. OF WATER RESOURCES, AUSTIN.

Corpus Christi Inner Harbor Water Quality Survey, August 1982,
W86-03440 5B

Texas Manufacturing Water Use: Long-Term Projections,
W86-03441 6D

Investigation of the Feasibility of Secondary Recovery of Ground Water from the Ogallala Aquifer: A Report to the Sixty-Eighth Legislature.
W86-03442 3B

TEXAS UNIV. AT AUSTIN. BUREAU OF ECONOMIC GEOLOGY.
Effects of Coastal Structures on Shoreline Stabilization and Land Loss - The Texas Experience,
W86-03863 2L

TEXAS UNIV. AT DALLAS, RICHARDSON. GRADUATE PROGRAM IN ENVIRONMENTAL SCIENCES.
Innovation in Wastewater Treatment,
W86-03884 5D

TEXAS UNIV. AT SAN ANTONIO. CENTER FOR APPLIED RESEARCH AND TECHNOLOGY.
Reduction of Trihalomethane Production with Optimal Disinfection Through Alternative Disinfection Systems,
W86-03542 5F

THAMES WATER AUTHORITY, LONDON (ENGLAND).
Modelling Nitrate Pollution in Water Resource Systems: The Thames Nitrate Project,
W86-03657 5G

THORN CREEK BASIN SANITARY DISTRICT, CHICAGO HEIGHTS, IL.
Computerization: Can It Work for You,
W86-03731 5D

TORONTO UNIV. (ONTARIO). DEPT. OF CIVIL ENGINEERING.
Dissolved Air Flotation for Primary and Secondary Clarification,
W86-03611 5D

TRACE METAL DATA INST., EL PASO, TX.
Removal of Various Toxic Heavy Metals and Cyanide from Water by Membrane Processes,
W86-03532 5D

TRW ENVIRONMENTAL ENGINEERING DIV., RESEARCH TRIANGLE PARK, NC.
Investigation on the Suitability of Various Pesticide Manufacturing Wastewater for Discharge to Municipal Waste Treatment Facilities,
W86-03900 5D

TSUKUBA UNIV. (JAPAN). INST. OF COMMUNITY MEDICINE.
Studies on Analytical Method of Acrylamide Monomer and Accumulation into Fish,
W86-03466 5B

TSUKUBA UNIV. (JAPAN). SCHOOL OF MEDICINE.
Accumulation of Acrylamide into Fish,
W86-03878 5C

UMWELTBUNDESAMT, BERLIN (GERMANY, F.R.).
Significance and Limitations of Environmental Compartmentalization Models in the Control of New Chemicals Based on the Organization for Economic Cooperation and Development Minimum Premarketing Set of Data,
W86-03423 5G

UNIVERSITY OF EAST ANGLIA, NORWICH (ENGLAND).
Rates of Erosion and Sediment Yield in the African Environment,
W86-03585 2J

UNIVERSITY OF SOUTH FLORIDA, TAMPA. DEPT. OF BIOLOGY.
Large-Scale Operations Management Test of Use of the White Amur for Control of Problem Aquatic Plants, Report 1: Baseline Studies, Volume V, The Herpetofauna of Lake Conway, Florida,
W86-03458 2H

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG (SOUTH AFRICA).
Environmental Isotope Hydrology in Southern Africa,
W86-03576 2F

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG (SOUTH AFRICA). DEPT. OF CIVIL ENGINEERING.
Optimization of Conjunctive Use of Groundwater and Surface Water Resources in the Vaal Basin,
W86-03573 4B

UPPSALA UNIV. (SWEDEN).
Hydrochemical Processes in Groundwater Discharge Areas,
W86-03762 2F

Surface and Groundwater Mixing and Identification of Local Recharge-Discharge Zones from Seasonal Fluctuations of Oxygen-18 in Groundwater in Fissured Rock,
W86-03790 2F

USTREDNI USTAV GEOLOGICKY, PRAGUE (CZECHOSLOVAKIA).
Mass-Balance Approach to the Understanding of Geochemical Processes in Aqueous Systems,
W86-03773 5B

UTAH WATER RESEARCH LAB., LOGAN.
Use of Bioassay Approaches for Assessing Phytoplankton Growth in Lakes and Reservoirs,
W86-03723 5C

Use of Solar Energy for Combined Municipal-Industrial Wastewater Treatment,
W86-03895 5D

UTRECHT RIJKSUNIVERSITEIT (NETHERLANDS).
Geochemical Studies in the Drainage Basin of the Rio Vouga (Portugal). I. General Hydrogeochemistry from Its Origin to the Ria de Aveiro,
W86-03776 2K

VERSAR, INC., SPRINGFIELD, VA.
Evaluation of the Published Literature in the Water Reuse/Recycle Area,
W86-03521 3E

VIRGINIA INST. OF MARINE SCIENCE, GLOUCESTER POINT.
Aquaculture Thesaurus: Descriptors Used in the National Aquaculture Information System,
W86-03643 10C

VRIJE UNIV., AMSTERDAM (NETHERLANDS).
Hydrochemistry of Springs from Dolomite Reefs in the Southern Alps of Northern Italy,
W86-03765 2K

VRIJE UNIV., AMSTERDAM (NETHERLANDS). INST. VOOR AARDWETENSCHAPPEN.
Isotope Studies as a Final Stage in Groundwater Investigations on the African Shield,
W86-03574 2F

Groundwater Quality Evolution in the Upper Aquifer of the Coastal Dune Area of the Western Netherlands,
W86-03761 2F

VSESOYUZNYI NAUCHNO-ISSLEDOVATEL'SKII INST. GIDROGEOLOGII I INZHENERDOI GEOLOGII, MOSCOW (USSR).
Simulation of Physicochemical Interactions in a Water-Rock System in Assessing Ground-Water Quality,
W86-03759 2K

WARD (PETER) AND ASSOCIATES, VANCOUVER (BRITISH COLUMBIA).
Solar Powered Groundwater Pumping for Medium Heads,
W86-03583 8C

WASHINGTON STATE DEPT. OF SOCIAL AND HEALTH SERVICES, OLYMPIA. OFFICE OF ENVIRONMENTAL HEALTH PROGRAMS.
Giardiasis in Washington State,
W86-03507 5C

WASHINGTON UNIV., SEATTLE. DEPT. OF CIVIL ENGINEERING.
Control of Non-Point Nutrient Caused Algal Problems Especially by Dilution,
W86-03488 5G

Predictive Model for Highway Runoff Pollutant Concentrations and Loadings,
W86-03834 2A

WATER RESEARCH CENTRE, MEDMENHAM (ENGLAND). MEDMENHAM LAB.
Nitrate Pollution of Groundwater Resources: Mechanisms and Modelling,
W86-03656 5B

Development of Techniques for the Isolation and Identification of Nonvolatile Organics in Drinking Water,
W86-03816 5A

WATER RESOURCES RESEARCH INST., ACCRA (GHANA).
Appraisal of Sediment Transport Measurement in Ghanaian Rivers,
W86-03586 7A

WATERLOO UNIV. (ONTARIO). DEPT. OF CHEMICAL ENGINEERING.
Waterloo Clarifier: Principles and Practice,
W86-03663 5D

Comparison of Stirred Suspension and Fixed Film Anaerobic Digestion Systems,
W86-03668 5D

WATERLOO UNIV. (ONTARIO). DEPT. OF EARTH SCIENCES.
Saline Groundwater Discharges from Crystalline Rocks Near Thunder Bay, Ontario, Canada,
W86-03786 2F

WESTON (ROY F.), INC., WEST CHESTER, PA.
Desk Top Methodology for Nonpoint Source Load Evaluation,
W86-03836 5B

WINDSOR UNIV. (ONTARIO). DEPT. OF CIVIL ENGINEERING.
Computation of Fractional Removal of Discrete and Flocculant Particles in Settling Basins,
W86-03667 5D

WINDSOR UNIV. (ONTARIO). GREAT LAKES INST.
Lead and Cadmium in Precipitation in the Essex Region of Southwestern Ontario,
W86-03772 5B

WINONA STATE UNIV., MN.
Ecological History of the Upper Mississippi River,
W86-03738 6G

Sediments of the Upper Mississippi River: Their Sources, Distribution, and Characteristics,
W86-03740 2J

WISCONSIN DEPT. OF NATURAL RESOURCES, MADISON.
Distribution and Relative Abundance of Fishes in Wisconsin; V: Grant and Platte, Coon and Bad Axe, and LaCrosse River Basins,
W86-03501 6G

WISCONSIN UNIV.-LA CROSSE. RIVER STUDIES CENTER.
Distribution and Enrichment of Trace Metals (Cd, Cr, Cu, Ni, Pb, Zn) in Bottom Sediments of Navigation Pools 4 (Lake Pepin), 5 and 9 of the Upper Mississippi River,
W86-03742 5B

WOODWARD-CLYDE CONSULTANTS, SAN FRANCISCO, CA.
WyCoal Gas Coal-Gasification Project; Preliminary Draft Environmental Impact Statement, Volume 2.
W86-03840 5G

WOODWARD-CLYDE CONSULTANTS, VICTORIA (BRITISH COLUMBIA).
Canadian Inland Waters: Coastal Environments and the Cleanup of Oil Spills,
W86-03621 5G

WORLD GLACIER INVENTORY, RIEDERALP (SWITZERLAND).
World Glacier Inventory Workshop: Proceedings of the Workshop at Riederalp, Switzerland,
W86-03673 2C

WYOMING UNIV., LARAMIE. DEPT. OF ATMOSPHERIC SCIENCE.
Ice Forming Experiment,
W86-03641 2C

WYOMING UNIV., LARAMIE. DEPT. OF ZOOLOGY AND PHYSIOLOGY.
Complex Effluent Fate Modeling,
W86-03429 5B

ZIMPRO, INC., ROTHSCHILD, WI.
Textile Waste Treatment at a Municipal PACT Facility,
W86-03893 5D

ACCESSION NUMBER INDEX

W86-03420 5B
W86-03421 5B
W86-03422 5B
W86-03423 5G
W86-03424 5B
W86-03425 5B
W86-03426 5B
W86-03427 5B
W86-03428 5B
W86-03429 5B
W86-03430 5B
W86-03431 5B
W86-03432 5B
W86-03433 5B
W86-03434 5G
W86-03435 6A
W86-03436 6D
W86-03437 3E
W86-03438 2H
W86-03439 2F
W86-03440 5B
W86-03441 6D
W86-03442 3B
W86-03443 5F
W86-03444 6D
W86-03445 3D
W86-03446 5G
W86-03447 5G
W86-03448 2L
W86-03449 2L
W86-03450 2E
W86-03451 5G
W86-03452 5G
W86-03453 5G
W86-03454 2H
W86-03455 5D
W86-03456 10F
W86-03457 5G
W86-03458 2H
W86-03459 2L
W86-03460 6E
W86-03461 5G
W86-03462 5G
W86-03463 5G
W86-03464 5G
W86-03465 2J
W86-03466 5B
W86-03467 2H
W86-03468 5G
W86-03469 5G
W86-03470 5G
W86-03471 5G
W86-03472 5G
W86-03473 5G
W86-03474 5G
W86-03475 5B
W86-03476 5G
W86-03477 5B
W86-03478 2F
W86-03479 8A
W86-03480 2H
W86-03481 7B
W86-03482 2H
W86-03483 4A
W86-03484 5G
W86-03485 5G
W86-03486 5G
W86-03487 2G
W86-03488 5G
W86-03489 5G
W86-03490 5G
W86-03491 2H
W86-03492 2H
W86-03493 2H
W86-03494 5G
W86-03495 3B
W86-03496 5A
W86-03497 2F
W86-03498 5B
W86-03499 7C
W86-03500 5B
W86-03501 6G
W86-03502 5C
W86-03503 2B
W86-03504 2H
W86-03505 8A
W86-03506 5A
W86-03507 5C
W86-03508 5B
W86-03509 6G
W86-03510 5E
W86-03511 5D
W86-03512 5A
W86-03513 5G
W86-03514 5E
W86-03515 5D
W86-03516 6G
W86-03517 2K
W86-03518 6G
W86-03519 8I
W86-03520 5D
W86-03521 3E
W86-03522 5A
W86-03523 5A
W86-03524 5A
W86-03525 5A
W86-03526 5A
W86-03527 5A
W86-03528 5A
W86-03529 5A
W86-03530 5A
W86-03531 7C
W86-03532 5D
W86-03533 5D
W86-03534 5D
W86-03535 5D
W86-03536 5D
W86-03537 5D
W86-03538 5D
W86-03539 5A
W86-03540 5F
W86-03541 5A
W86-03542 5F
W86-03543 5F
W86-03544 5B
W86-03545 2K
W86-03546 5B
W86-03547 2E
W86-03548 2F
W86-03549 5B
W86-03550 2E
W86-03551 4A
W86-03552 2E
W86-03553 2F
W86-03554 2E
W86-03555 2F
W86-03556 2E
W86-03557 10D
W86-03558 2F
W86-03559 2E
W86-03560 6D
W86-03561 2L
W86-03562 2F
W86-03563 2F
W86-03564 2F
W86-03565 2F
W86-03566 2F
W86-03567 2F
W86-03568 2F
W86-03569 2K
W86-03570 2F
W86-03571 2F
W86-03572 4B
W86-03573 4B
W86-03574 2F
W86-03575 2F
W86-03576 2F
W86-03577 2F
W86-03578 2F
W86-03579 6E
W86-03580 7C
W86-03581 7B
W86-03582 5G
W86-03583 8C
W86-03584 2J
W86-03585 2J
W86-03586 7A
W86-03587 2J
W86-03588 4D
W86-03589 2J
W86-03590 2J
W86-03591 7B
W86-03592 7B
W86-03593 2J
W86-03594 2J
W86-03595 4D
W86-03596 2J
W86-03597 2J
W86-03598 2J
W86-03599 2J
W86-03600 4D
W86-03601 4D
W86-03602 4D
W86-03603 4D
W86-03604 2J
W86-03605 2J
W86-03606 2J
W86-03607 2J
W86-03608 2J
W86-03609 2E
W86-03610 5G
W86-03611 5D
W86-03612 5E
W86-03613 5D
W86-03614 2A
W86-03615 3A
W86-03616 2L
W86-03617 5D
W86-03618 2B
W86-03619 5D
W86-03620 5C
W86-03621 5G
W86-03622 6F
W86-03623 5B
W86-03624 5D
W86-03625 5G
W86-03626 4A
W86-03627 5G
W86-03628 7A
W86-03629 5G
W86-03630 5B
W86-03631 5D
W86-03632 5D
W86-03633 5E
W86-03634 6G
W86-03635 5E
W86-03636 2G
W86-03637 5B
W86-03638 5B
W86-03639 5D
W86-03640 2A
W86-03641 2C
W86-03642 6G
W86-03643 10C
W86-03644 5B
W86-03645 6G
W86-03646 2A
W86-03647 2B
W86-03648 5B
W86-03649 5G
W86-03650 5G
W86-03651 5B
W86-03652 5G
W86-03653 5G
W86-03654 5G
W86-03655 7A
W86-03656 5B
W86-03657 5G
W86-03658 5G
W86-03659 5D
W86-03660 5D
W86-03661 5D
W86-03662 5D
W86-03663 5D
W86-03664 5D
W86-03665 5D
W86-03666 5D
W86-03667 5D
W86-03668 5D
W86-03669 5D
W86-03670 5D
W86-03671 5D
W86-03672 5D
W86-03673 2C
W86-03674 2C
W86-03675 2C
W86-03676 2C
W86-03677 2C
W86-03678 2C
W86-03679 2C
W86-03680 2C
W86-03681 2C
W86-03682 2C
W86-03683 2C
W86-03684 2C
W86-03685 2C
W86-03686 2C
W86-03687 2C
W86-03688 2C
W86-03689 2C
W86-03690 2C
W86-03691 2C
W86-03692 2C
W86-03693 2C
W86-03694 2C
W86-03695 2C
W86-03696 2C
W86-03697 2C
W86-03698 2C
W86-03699 2C
W86-03700 2C
W86-03701 2C
W86-03702 2C
W86-03703 2C
W86-03704 2H
W86-03705 2H
W86-03706 2H
W86-03707 2H
W86-03708 5G
W86-03709 5C
W86-03710 2H
W86-03711 2L
W86-03712 5C
W86-03713 8I
W86-03714 5B
W86-03715 6E
W86-03716 2H
W86-03717 2H
W86-03718 2H
W86-03719 2H
W86-03720 2H
W86-03721 2H
W86-03722 5G
W86-03723 5C
W86-03724 2H
W86-03725 2H
W86-03726 2H
W86-03727 5D
W86-03728 5D
W86-03729 5D
W86-03730 5D
W86-03731 5D
W86-03732 5D
W86-03733 5D
W86-03734 5D
W86-03735 5D
W86-03736 5D
W86-03737 6G
W86-03738 6G
W86-03739 6G
W86-03740 2J
W86-03741 2J
W86-03742 5B
W86-03743 5B
W86-03744 5B
W86-03745 5B
W86-03746 5B
W86-03747 5B
W86-03748 5B
W86-03749 5B
W86-03750 5B
W86-03751 7A
W86-03752 6G
W86-03753 5B
W86-03754 2K

ACCESSION NUMBER INDEX

W86-03755	2G
W86-03756	2K
W86-03757	2F
W86-03758	2F
W86-03759	2K
W86-03760	2K
W86-03761	2F
W86-03762	2F
W86-03763	2F
W86-03764	2F
W86-03765	2K
W86-03766	2A
W86-03767	7A
W86-03768	2F
W86-03769	7A
W86-03770	7A
W86-03771	2K
W86-03772	5B
W86-03773	5B
W86-03774	5B
W86-03775	5B
W86-03776	2K
W86-03777	2K
W86-03778	2K
W86-03779	5B
W86-03780	5B
W86-03781	5B
W86-03782	5C
W86-03783	2F
W86-03784	2F
W86-03785	2K
W86-03786	2F
W86-03787	2J
W86-03788	5B
W86-03789	2A
W86-03790	2F
W86-03791	5A
W86-03792	5A
W86-03793	5A
W86-03794	5A
W86-03795	5A
W86-03796	5A
W86-03797	5A
W86-03798	5A
W86-03799	5A
W86-03800	5A
W86-03801	5A
W86-03802	5A
W86-03803	5A
W86-03804	5A
W86-03805	5A
W86-03806	5A
W86-03807	5A
W86-03808	5A
W86-03809	5A
W86-03810	5A
W86-03811	5A
W86-03812	5A
W86-03813	5A
W86-03814	5A
W86-03815	5A
W86-03816	5A
W86-03817	5A
W86-03818	5A
W86-03819	5A
W86-03820	5A
W86-03821	5A
W86-03822	5B
W86-03823	5B
W86-03824	5A
W86-03825	2J
W86-03826	5B
W86-03827	5A
W86-03828	5B
W86-03829	7B
W86-03830	5D
W86-03831	2A
W86-03832	3A
W86-03833	2A
W86-03834	2A
W86-03835	2A
W86-03836	5B
W86-03837	5B
W86-03838	5B
W86-03839	5B
W86-03840	5G
W86-03841	10D
W86-03842	5D
W86-03843	5D
W86-03844	5D
W86-03845	5D
W86-03846	2B
W86-03847	2B
W86-03848	8C
W86-03849	2D
W86-03850	2J
W86-03851	2J
W86-03852	2J
W86-03853	2J
W86-03854	6G
W86-03855	6G
W86-03856	2L
W86-03857	2L
W86-03858	2L
W86-03859	2L
W86-03860	6E
W86-03861	6G
W86-03862	2L
W86-03863	2L
W86-03864	2J
W86-03865	2J
W86-03866	2L
W86-03867	5G
W86-03868	5G
W86-03869	5C
W86-03870	5D
W86-03871	5D
W86-03872	5D
W86-03873	5B
W86-03874	5E
W86-03875	5B
W86-03876	5G
W86-03877	5A
W86-03878	5C
W86-03879	5E
W86-03880	5G
W86-03881	7A
W86-03882	5E
W86-03883	5D
W86-03884	5D
W86-03885	5D
W86-03886	6C
W86-03887	5D
W86-03888	5D
W86-03889	5D
W86-03890	5D
W86-03891	5D
W86-03892	5D
W86-03893	5D
W86-03894	5D
W86-03895	5D
W86-03896	5D
W86-03897	5E
W86-03898	5A
W86-03899	5D
W86-03900	5D

* U. S. GOVERNMENT PRINTING OFFICE : 1986 491-069/40000

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

10 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSSION NUMBER INDEX

NORTH AMERICAN CONTINENT PRICE SCHEDULE

Customers in Canada, United States, and Mexico please use this price schedule; other addressees, write for PR-360-4.

MICROFICHE

A01	$5.95

PAPER COPY

A02 and A03	9.95
A04 and A05	11.95
A06 through A09 (inclusive)	16.95
A10 through A13 (inclusive)	22.95
A14 through A17 (inclusive)	28.95
A18 through A21 (inclusive)	34.95
A22 through A25 (inclusive)	40.95
A99	*
N01	45.00
N02	48.00

E01	$7.50
E02	10.00
E03	11.00
E04	13.50
E05	15.50
E06	18.00
E07	20.50
E08	23.00
E09	25.50
E10	28.00
E11	30.50
E12	33.00
E13	35.50
E14	38.50
E15	42.00
E16	46.00
E17	50.00
E18	54.00
E19	60.00
E20	70.00
E99	*

T01	$145.00
T02	160.00
T03	275.00
T04	370.00
T05	460.00
T06	535.00
T07	610.00
T08	685.00
T09	760.00
T10	835.00
T11	910.00
T12	985.00
T13	1,060.00
T14	1,135.00
T15	1,210.00
T16	1,285.00
T17	1,360.00
T18	1,435.00
T19	1,510.00
T99	*

*Contact NTIS for price quote.

PRICES EFFECTIVE JANUARY 1, 1986

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

OFFICIAL BUSINESS
Penalty for Private Use, $300

AN EQUAL OPPORTUNITY EMPLOYER

BULK RATE
POSTAGE & FEES PAID
NTIS
Permit No. G-292